

POPULAR MECHANICS

MAGAZINE

SO YOU CAN UNDERSTAND IT

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JANUARY
1946
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SEE PAGE 8





Proven by our fighters - First choice for **YOU**

**SEALED IN STEEL
It's LEAKPROOF 2 Ways...**

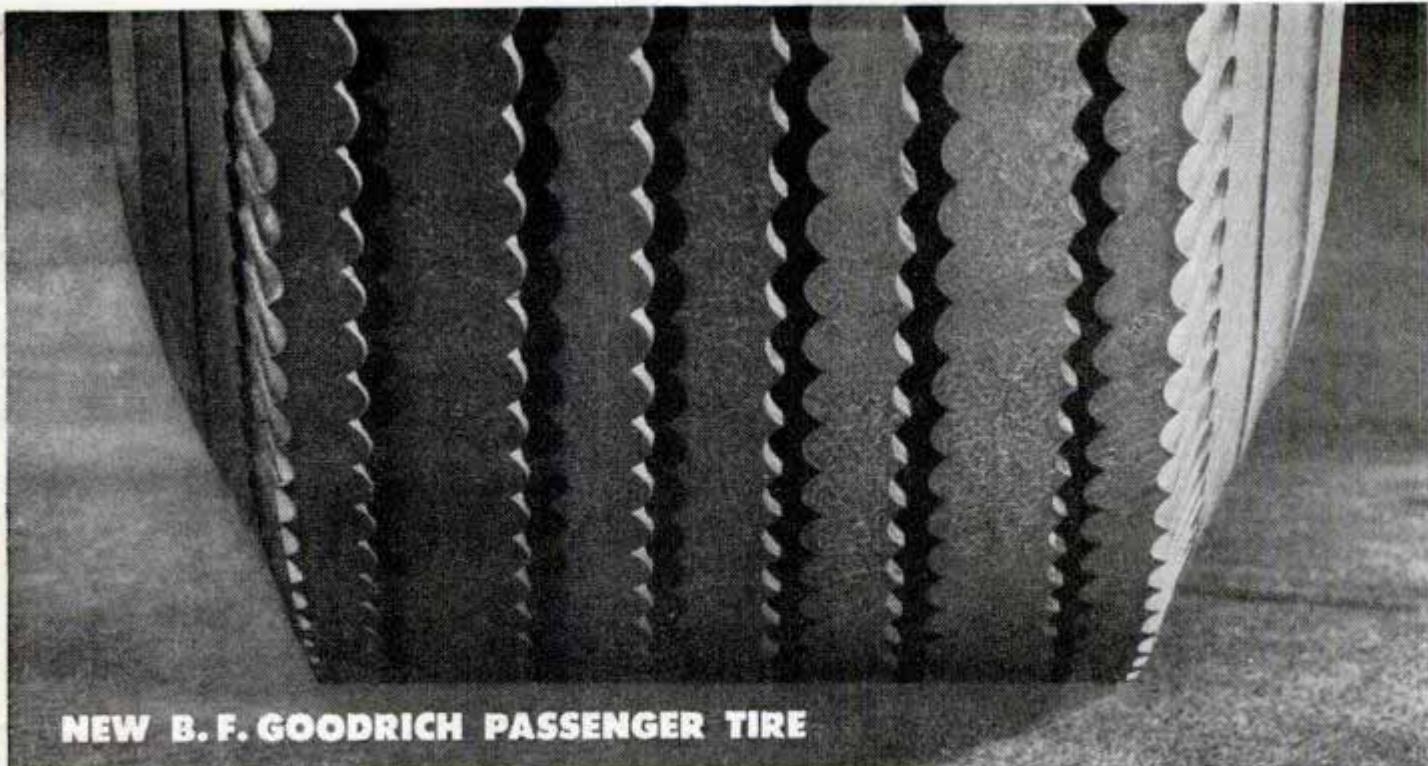
1 Power is sealed in—your flashlight works when you need it, even for years and years.

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Leakproof **10¢**
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NEW B. F. GOODRICH PASSENGER TIRE

New B. F. Goodrich synthetic TIRE THAT OUTWEARS PREWAR TIRES!

"**A MIRACLE,**" some have called it! Few believed that a tire could ever be made of synthetic rubber that would actually outdistance those made of prewar natural rubber. Yet here it is, the new B. F. Goodrich Silvertown. And here are some of the reasons for its longer-than-prewar mileage:

New, better rubber

A new rubber, so superior that for a long time it was a closely guarded military secret, was developed by B. F. Goodrich. Tires made with this rubber wear longer, run cooler. They have greater resistance to cracking—actually are more resistant to bruising and damage from accidents. But rubber is only one reason why the new B. F. Goodrich Silvertown outwears prewar tires.

New road-level tread

In the picture above, note how the tread is flatter—puts more rubber on the road. This means that

more rubber shares the wear, spreads it evenly over the whole tread surface. No more worn-out-in-the-middle treads. The result: more mileage, better traction, more skid-resistance and greater safety.

The tire body is more rugged, too. B. F. Goodrich developed a stronger cotton cord for this tire. And more cords are used than in prewar tires. Another feature that means more miles, greater safety for you.

Nearly 17 million test miles

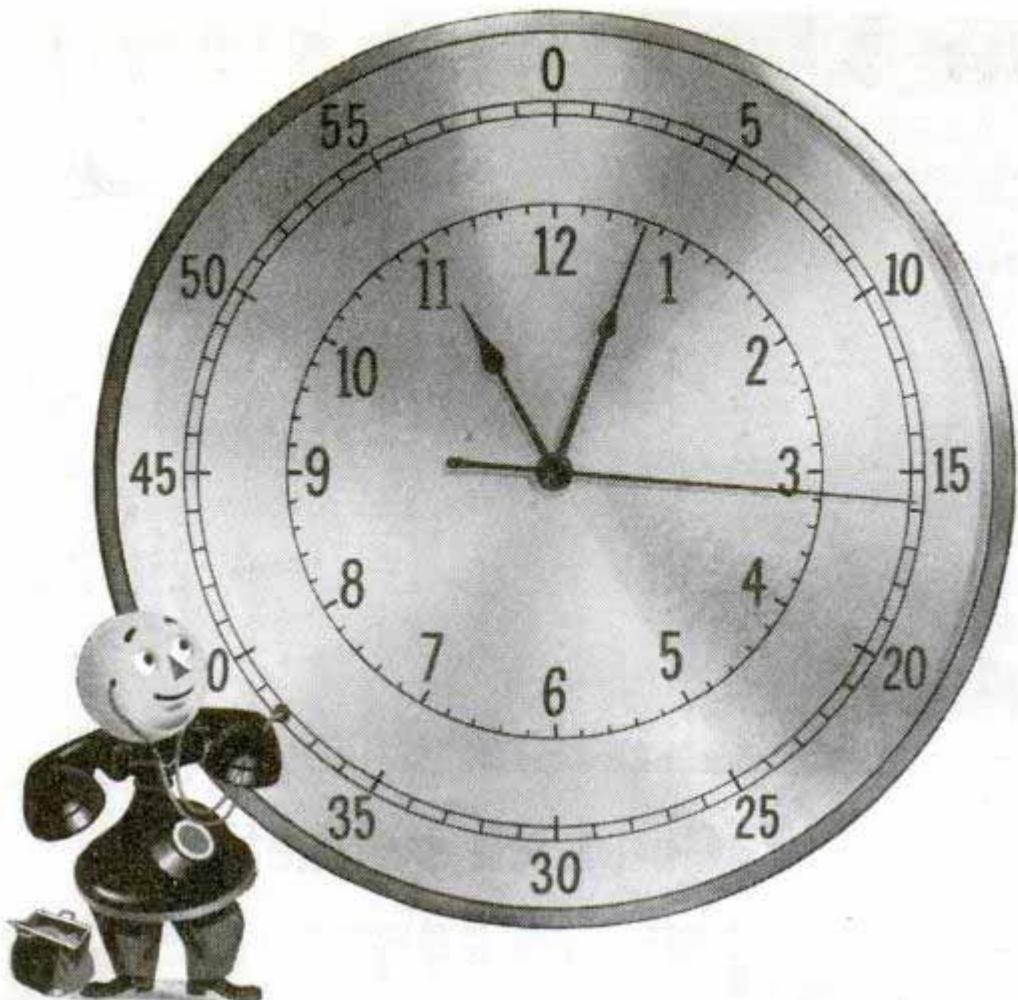
Over 2,000 tests have been made with this new tire. Taxi fleets, state police cars, and the B. F. Goodrich test fleet have rolled up nearly 17 million miles under all kinds of driving conditions. The new B. F. Goodrich Silvertown gives longer tread wear . . . actually outdistances prewar tires.

3 years' EXTRA experience

The first B. F. Goodrich tires containing synthetic rubber were

sold to American motorists 18 months before Pearl Harbor. That was three full years before any other tire manufacturer . . . three years during which B. F. Goodrich has been piling up extra synthetic rubber tire experience. This three-year head start is another reason why you can count on extra mileage . . . extra safety . . . extra value from the new B. F. Goodrich Silvertown. Supplies are still limited, of course, but we hope to have much larger quantities in the hands of most dealers within the next few months. *The B. F. Goodrich Co., Akron, O.*

More miles with
B.F. Goodrich
FIRST IN RUBBER



Clocks with tiny crystal hearts that beat 100,000 times a second

CRYSTAL HEARTS beat time in Bell Telephone Laboratories, and serve as standards in its electronics research. Four crystal clocks, without pendulums or escapements, throb their cycles without varying by as much as a second a year.

Precise time measurements may seem a far cry from Bell System telephone research, but time is a measure of frequency, and frequency is the foundation of modern communication, whether transmission is by land lines, cable, or radio.

These clocks are electronic devices developed by Bell Laboratories, and refined over years of research. Their energy is supplied through vacuum tubes, but the accurate timing, the controlling heart of

the clock, is provided by a quartz crystal plate about the size of a postage stamp.

These plates vibrate 100,000 times a second, but their contraction and expansion is less than a hundred-thousandth of an inch. They are in sealed boxes to avoid their variation in atmospheric pressure, and temperatures are controlled to a limit as small as a hundredth of a degree.

Bell Laboratories was one of the first to explore the possibilities of quartz in electrical communication, and its researches over many years enabled it to meet the need for precise crystals when war came. The same character of research is helping to bring ever better and more economical telephone service to the American people.



BELL TELEPHONE LABORATORIES Exploring and inventing, devising and perfecting for continued improvements and economies in telephone service.

Popular Mechanics Magazine

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H. H. WINDSOR, Jr., Editor and Publisher

Next Month

SCORES of radar articles have been written since censorship was lifted, but the best of them all is told by two Navy officers "who were there." One served as fighter direction officer on the Wasp; the other in the Gilberts and Marshalls. Their story—as filled with adventure as Terry and the Pirates and as clear as ABC—tells how the Navy directed its fighters in fog and darkness. The first installment of "Radar Cues the Navy Fighters" is in the February issue.

ERNEST WARTHNER of Dover, Ohio, can take an old water bucket or an elephant's tusk and create something that museums fight over. This "Artist With a Pocket Knife," featured next month, has a collection which includes the history of the locomotive done in ivory, ebony, black walnut and pearl. His collection is valued at a half million dollars.

THE destiny of nations has hinged on a whim of weather. Uncle Sam spent a billion dollars during the war on rain-or-shine research and service. A February article reveals new techniques in forecasting the weather.

NUTCRAFT may not be in the dictionary, but you'll find an article about how to do it in the February issue. Necklaces, belts, and unique curios can be made in the home workshop.

SHORT-WAVE listeners and radio amateurs will want to build the three-tube short-wave super described next month. It covers many "ham" bands and foreign broadcasts.

JUST like a picture, a house requires the proper "frame" in the form of an ornamental fence. A variety of pleasing designs is presented in the Craftsman section in February.

Volume 85	JANUARY 1946	Number 1
Managing Editor.....	Roderick M. Grant	
Assistant Managing Editor.....	Wayne Whittaker	
Shop Notes and Crafts Editor.....	James R. Ward	
Radio and Electronics Editor.....	Frank L. Brittin	
Art Director.....	Frank Beatty	
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In This Issue

Long Distance by Short Wave	- - - - -	1
FIDO Fights Fog	- - - - -	12
Flying Freight	- - - - -	20
Sweeping Up Sudden Death	- - - - -	28
Homes to Fit the Family	- - - - -	36
It's Time to Open the Shutters	- - - - -	43
Sinews of Wire	- - - - -	50
Navigation for the Sky Tourist	- - - - -	58
They Police California's Rain	- - - - -	65
Modeling With Nuts and Bolts	- - - - -	76
China's Underground Arsenal	- - - - -	82
Aussie "G Idea Pool"	- - - - -	86

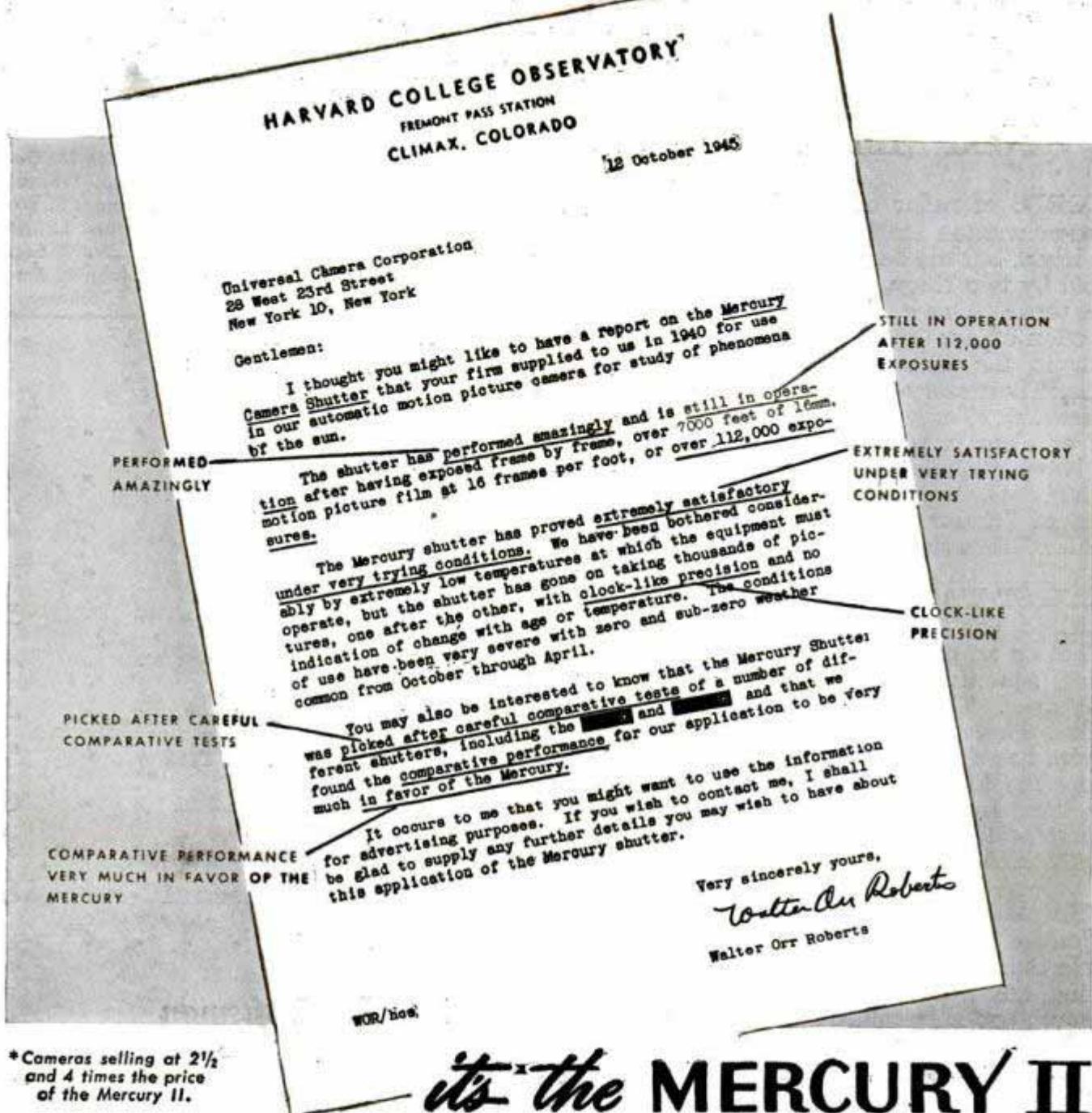
For the Craftsman

Cacti—All-Season House Plants	- - - - -	99
Fun With a Jackknife	- - - - -	108
18-In. Model of Overland Stagecoach	- - - - -	115
Single-Negative Design Photos	- - - - -	122
Tractor Scoops From Scrap Materials	- - - - -	133
Radio and Electronics	- - - - -	141

Other items, and manufacturers of available products described, are listed on pages 8A and 10A

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The Camera that went to Harvard



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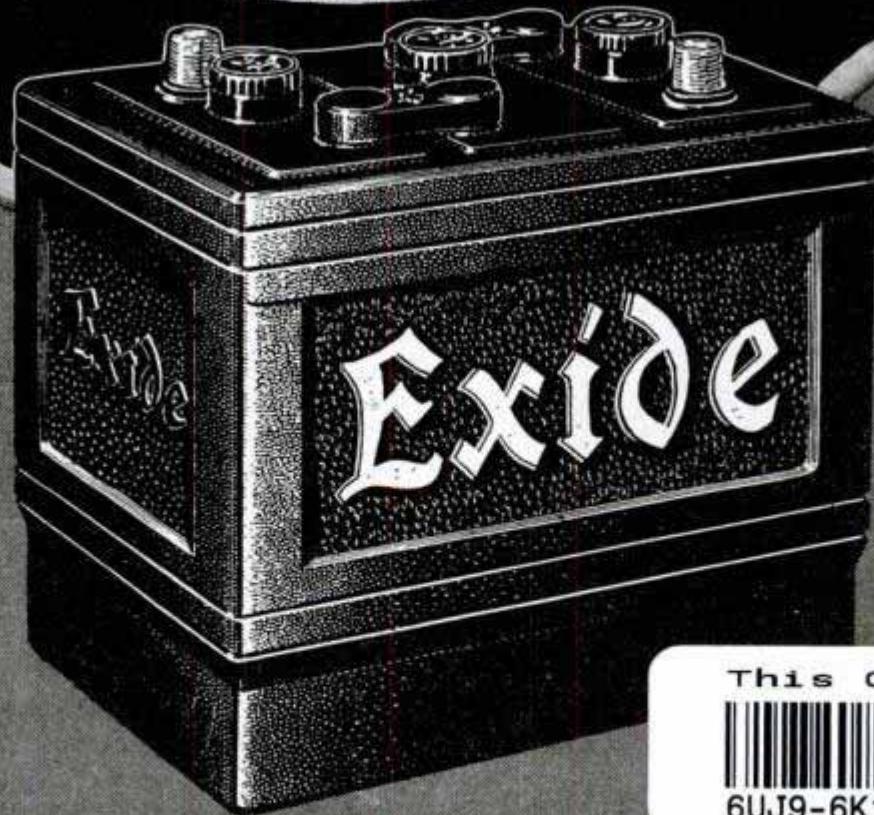


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WHERE-TO-BUY-IT INDEX

Manufacturer's name and address appear in parentheses directly after items believed by us to be commercially available

AVIATION

Fighter planes that missed the war.....	7
New bomber-transport has propellers in rear.....	10
Signs replace lung power in aircraft plant.....	17
Most powerful aircraft engine develops 5500 horsepower.....	70
Vampire is newest British jet-propelled plane.....	71
Portable airfield floats in the sea.....	74
Metal "fish" scoops water for blimp's ballast.....	85

FARM

Glass-lined silo (A. O. Smith Corp., Milwaukee, Wis.).....	6
Jeep tows corn binder and furnishes power.....	10
Cyclone duster sprays insect-killing chemical (Niagara Sprayer & Chemical Co., 3343 Niagara St., Middleport, N. Y.).....	19
Cranberry picker (A. V. Anderson, Grayland, Wash.).....	19
Heating element prevents ice from forming in water tanks (General Electric Co., Schenectady, N. Y.).....	55
Hand-operated garden tractor (Ellinwood Industries, 150 W. Slauson Ave., Los Angeles 3, Calif.).....	55
Irrigation revives fur trapping.....	56

HOME IMPROVEMENTS

Fuel saver for oil heaters (Beachhead Mfg. Co., 1906 S. Keisel St., Bay City, Mich.).....	6
89-pound oil burner has no exposed parts (Torridheat Division, Cleveland Steel Products Corp., Cleveland 2, Ohio).....	18
Faucet washer easy to install (Durst Mfg. Co., Inc., 462 Broadway, New York 13).....	35
Folding electric ironer (Electric Utilities Corp., 2115 S. 54th St., Cicero, Ill.).....	40
Electric ironer has knee control (Nineteen Hundred Corp., St. Joseph, Mich.).....	40
Electric dishwasher shuts itself off (Westinghouse Electric Corp., Mansfield, Ohio).....	40
Jan opener attaches to shelf (Aircraftsman Co., 223 Hindry Ave., Inglewood, Calif.).....	40
Cordless electric iron (Eureka Vacuum Cleaner Co., 574 W. Randolph St., Chicago).....	41
Table lamp uses fluorescent tube (Chicago Lighting Institute, 72 W. Adams St., Chicago).....	41
Ash tray has safety edge (Aircraftsman Co., 223 Hindry Ave., Inglewood, Calif.).....	41
Garage light waits three minutes before going out (T. J. Mudon Co., 1240 Merchandise Mart, Chicago).....	41
Garage doors open and close automatically (Purdy Door-Operator Co., 342 Madison Ave., New York).....	64
Bottle holder feeds baby (Feederette Co., 7207 Myron Ave., Cleveland, Ohio).....	70
Vacuum unit keeps steam radiators working (Leiman Bros. Inc., 127 Christie St., Newark 5, N. J.).....	81
Shutters in glass window open like Venetian blind (Nu-Air-Wa Co., 601 S. Vermont Ave., Los Angeles 5, Calif.).....	88
Indoor clothes drier fastened to wall (Wm. P. Horn, 1355 Market St., San Francisco, Calif.).....	88
Handle feeds cleaning fluid into brush (Rivet-O Mfg. Co., 195 Main St., Orange, Mass.).....	88

INDUSTRY

Glove drier protects welders.....	35
Bulldozer-crane on tractor (Hyster Co., Portland, Ore.).....	39
Film sprayed on glass peels off when dirty.....	39
Two-color spray gun (Sherwin Williams Co., 101 Prospect Ave., N.W., Cleveland, Ohio).....	55
Air cleaner blows soot out of boiler tubes (Compressed Air Institute, Rm. 1111, Terminal Tower, Cleveland, Ohio).....	70
Monster and midget drills aided war production.....	72
Multiple drill head has movable spindles (Commander Mfg. Co., 4225 W. Kinzie St., Chicago 24).....	81
Resin toughens plaster of paris (Furane Plastics & Chemicals Co., 233 W. San Fernando Rd., Los Angeles 26, Calif.).....	81
Plastic treatment for wood (Koppers Co., Orrville, Ohio).....	85

MILITARY

Ultra-high-frequency radio mine detector.....	11
Mine scenting jeep locates buried explosives.....	15
Electric torpedoes leave no telltale wake.....	18
British battleship refuels two destroyers simultaneously.....	71
China's underground arsenals provided tools of war.....	82

TRANSPORTATION

Rotary snowplow throws snow 125 feet.....	8
Home mechanics build three-wheeled "Junkmobiles".....	11
British try plastic rail car with special spring body.....	19
Hinged cab for motor truck makes engine accessible.....	35
Ice truck lifts own body to top of rail car.....	42
Jet engine modeled after buzz-bomb has no rotating parts (G. M. Giannini & Co., 161 E. California St., Pasadena, Calif.).....	64
Divan for railroad car converts into sleeping unit.....	70
Truck rides wooden rails over Quebec swampland.....	71

MISCELLANEOUS

Book cover folds into upright holder (Robert W. Brown, 1731 F St., N. W., Washington, D. C.).....	16
Light beam matches automobile paints (Acme White Lead & Color Works, Detroit, Mich.).....	39
Magnet "freezes" footprint in ball bearings.....	42
Hobbyist makes tiny horses of balsa wood and calfskin.....	49
Firemen carry their own "fresh air" (Scott Aviation Corp., Lancaster, N. Y.).....	55
Watertight camera takes pictures under water.....	57
New X-ray machine may unlock atomic secrets.....	63
Pocket-size check perforator (Esquire Products Co., 2948 E. Walnut St., Pasadena 8, Calif.).....	63
Map of U. S. made of stamps.....	70
"Beer barrel" boat to cross Atlantic.....	70
Air pictures guide rebuilding of bombed-out Britain.....	75
Robot golf "pro" teaches duffers (Dave Bauer, 3748 Chatwin Ave., Long Beach 8, Calif.).....	75
Telephoto camera films horse race from start to finish.....	85
Pocket radio receiver is a 5-tube super (Belmont Radio Corp., 5921 W. Dickens Street, Chicago).....	141

(Continued to page 10A)



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(Continued from page 8A)

Craftsman and Shop Notes Index

ART AND ARTIST

Copying drawings simplified by using ruled glass.....	96
Masking tape holds cards for spraying.....	98
Guide tabs minimize eyestrain in drawing parallel lines.....	140

AUTOMOTIVE

Leather strips form pockets in glove compartment.....	112
Plumb bob indicates uneven loading of truck.....	126
Adjustable engine positioner has many uses.....	129
Panel across garage doors conserves heat in winter.....	132
Drop-leaf tailboard on truck facilitates sorting loads.....	137

FARM

Hook locks grain-blower piping.....	92
Roofing tar prevents fence posts from decaying.....	98
Chart computes number of acres in rectangular tract of land.....	112
Stock cars used for corn crib and overhead granary.....	138
Feed cooker made from oil drum.....	139
Olive oil stored in ax handle prevents drying of hands.....	140

HOME IMPROVEMENTS

Glass jar replaces lamp bowl.....	92
Sliding roof on dog house permits easy cleaning.....	92
Solving home problems.....	94
Gate latch has no moving parts.....	103
Washing machine improved by adding extra paddles.....	104
Repairing broken alarm-clock spring.....	104
Adhesive tape will muffle doorbell.....	106
Cabinet attached to door provides closet space.....	113
Pipe and fan in fireplace warm room by circulating air.....	120
Broken andiron repaired with pipe.....	120

OFFICE

Gummed-paper tape used to make index tabs.....	96
Carbon paper creased diagonally to prevent curling.....	106
Markers and holder save time in locating files.....	114
Tab frees gummed-tape roll when end is stuck.....	120
Typist's copyholder improvised from writing board.....	128
Pins aid lining up original page with carbon copy.....	140

PHOTOGRAPHY

Two types of improvised darkroom safelights.....	121
Extra-long lens hood permits taking photos against sun.....	121
Perforated board used as easel for copying photographs.....	124
Cut-film hanger holds many sheets.....	124
Hose used to control photo-tank temperature.....	124
Plug-in lamps illuminate projector when changing reels.....	124

RADIO AND ELECTRONICS

Five-tube superheterodyne receiver fits in pocket.....	141
"Sound" amplifier for converted 16-mm. home movie projector.....	142
Comparison chart for common radio and industrial symbols.....	144
Cleaning radio switches and volume controls.....	144
How to add a directional reflector to an FM dipole antenna.....	144
Simplest practical tone control for small set.....	144
Fuse puller removes "hot" metal tubes.....	144
Table dolly handy for moving test sets on workbench.....	144
Locating loose connections that cause crackling noises.....	144

SPORTS

Bamboo poles and auto casings become pole-vault standards.....	92
Lipstick case encloses bowler's crayon.....	96
Blocks permit walking on skate runners.....	104

STORE AND SHOP

"Absence indicator" made from cardboard and cord.....	107
Four-operator grid unit for welding machines.....	125
Air compressor operates without moving parts.....	127
Stranded wire wound on reels with electric drill.....	128
Wood sheath protects soapstone stick.....	132
Pans converted to stock bins provide additional space.....	138
Showcase lock protects wares.....	138

TOOLS

Handle for chisel held by U-bolt.....	98
Holder bolted to lathe housing keeps chuck wrench handy.....	128
Tool holder simplifies convex turning.....	130
Counter improvised from compass to aid printers.....	132
Chucks and face plates repaired with ring inserts.....	132
Attachment extends use of wrench.....	137
How to improve a soldering iron.....	138
Lathe backstop supports thin work for facing.....	139

TOYS AND NOVELTIES

Toy houseboat will amuse young sailors.....	91
Whistle made from fountain pen cap.....	96
Four-place coaster has positive brake.....	97
Lacquered capsules make colorful beads.....	104
Star stamp cut from bottle cork.....	104
Cigarette lighter made from .50-cal. cartridge case.....	107
Remote-control switch for model railways.....	111
Strips over slot in child's bank prevent removal of coins.....	114

WOODWORKING

Duncan Phyfe lyre table.....	89
Four-part trinket box scrollawed in one operation.....	93
Cabinet fitted to circular saw serves as sawdust catcher.....	98
Magazine rack has sides made of woven splints.....	105
Glued column work is clamped by cord in hand-screw jaws.....	106
Drill-press attachment shapes masts for model ships.....	106
Clamping arrangement holds work for hand mortising.....	120

MISCELLANEOUS

Mucilage applied to scrapbook clippings with oilcan.....	93
Refilling small spouted cans from bottle.....	106
Dating stamp for concrete work uses old license plates.....	112
Hot plate made from tin can and heat-lamp element.....	114
Bracing protects record album when being shipped.....	114
Leather strip on edge of helmet protects welder's neck.....	132
Ice pick is used to bend glass tubing.....	132
Control operates overhead stop cocks.....	140

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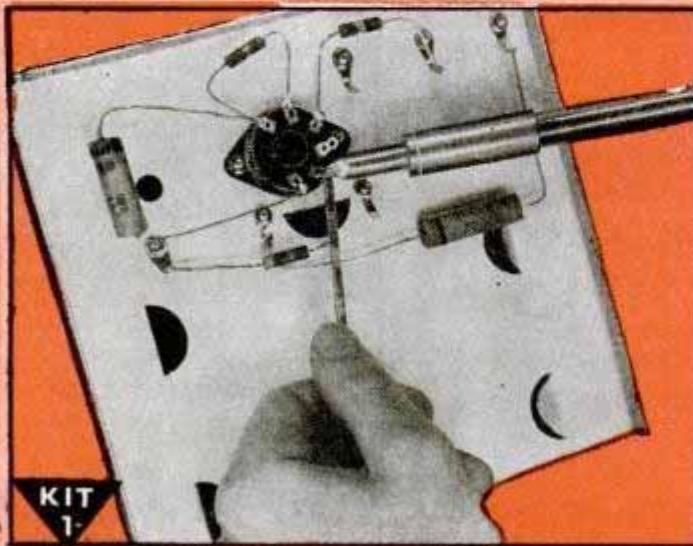
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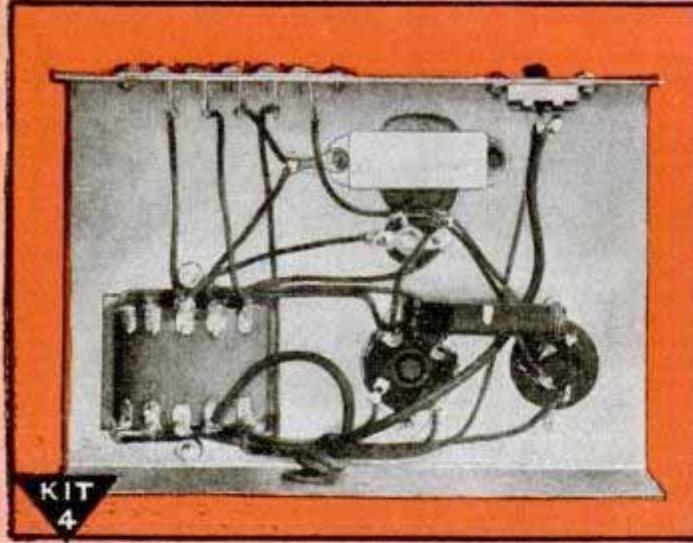
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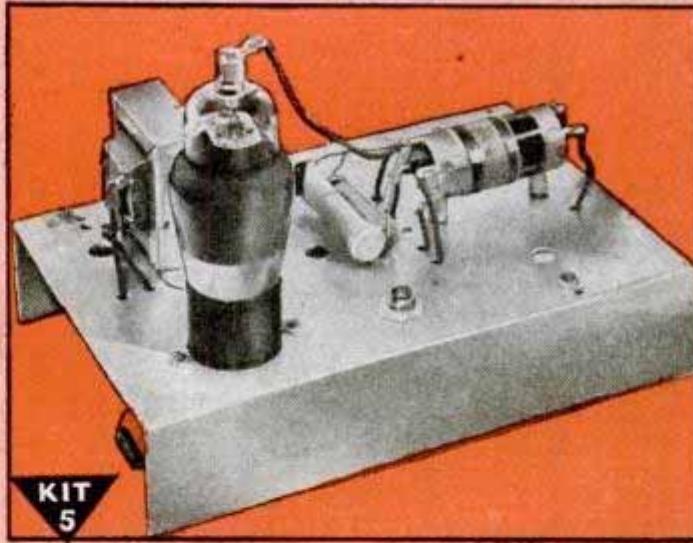
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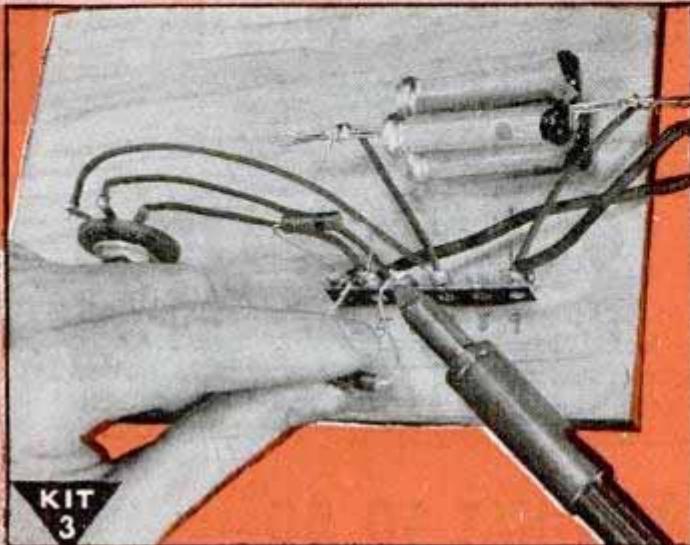
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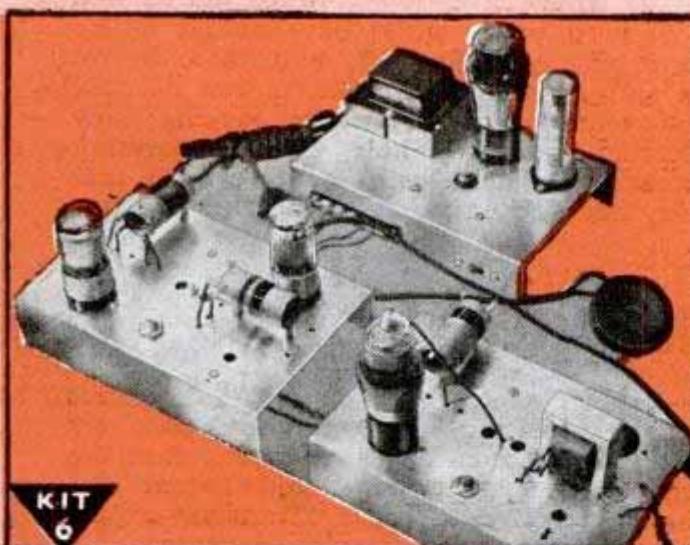
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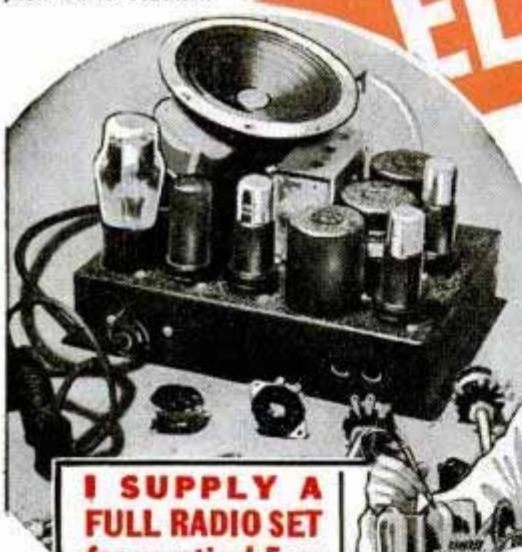


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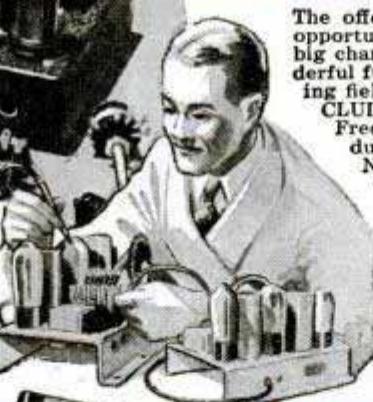
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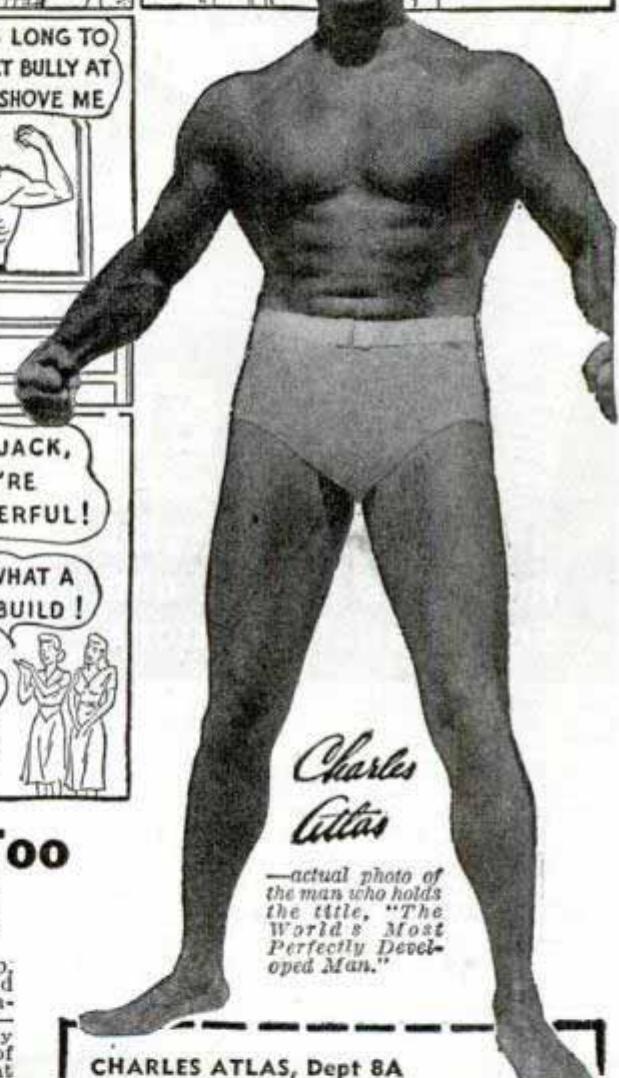
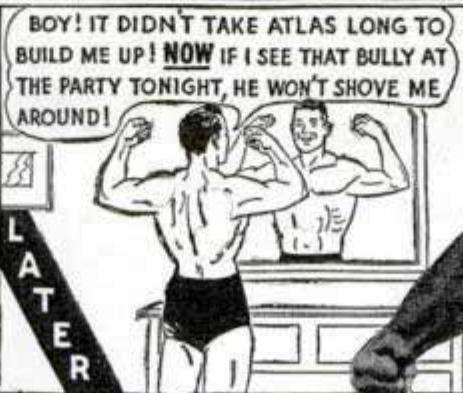
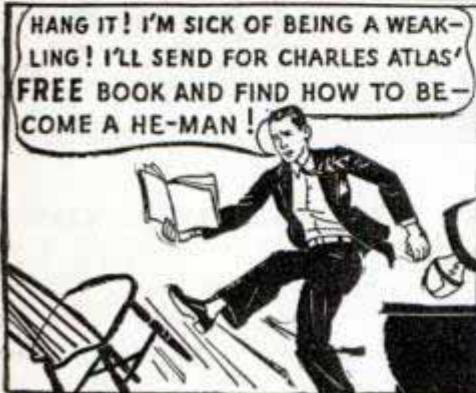
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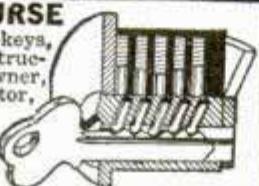
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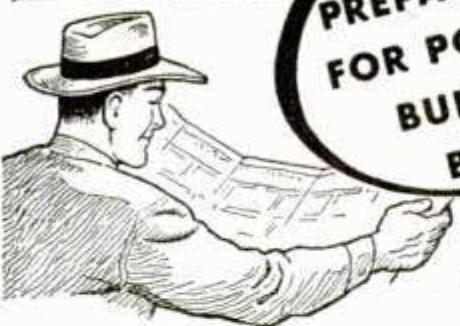
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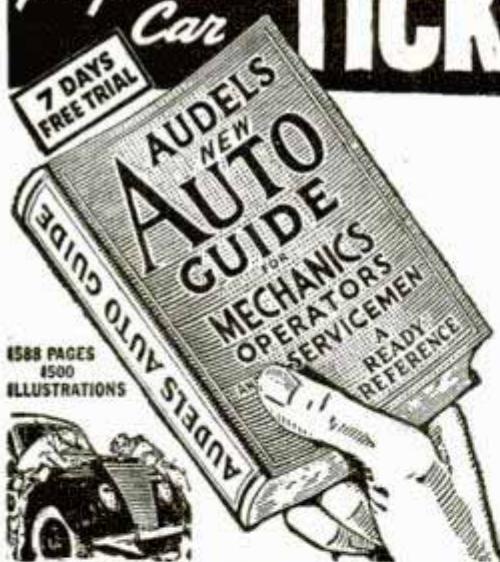
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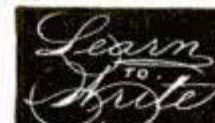
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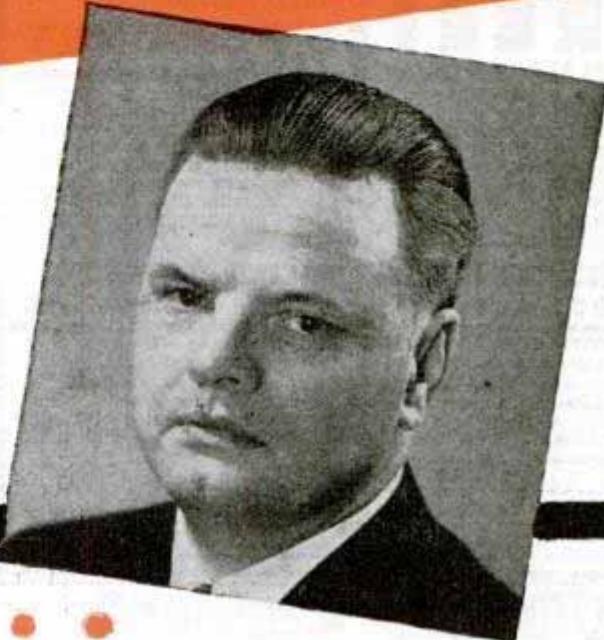
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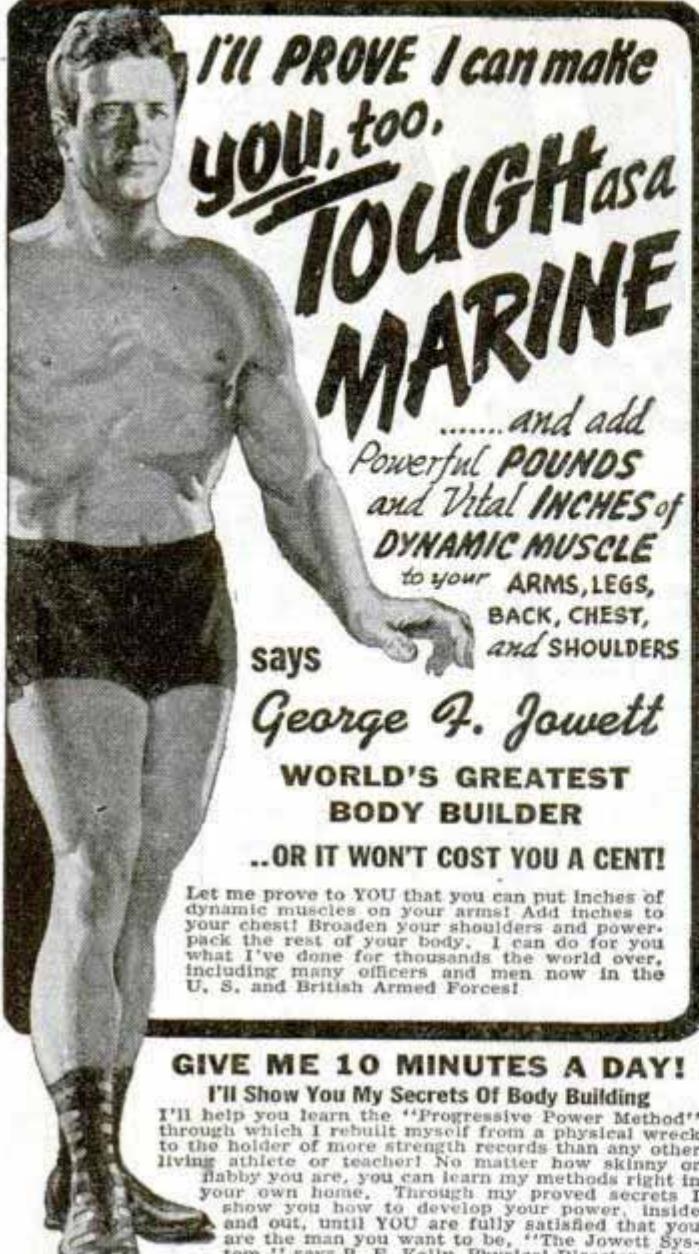
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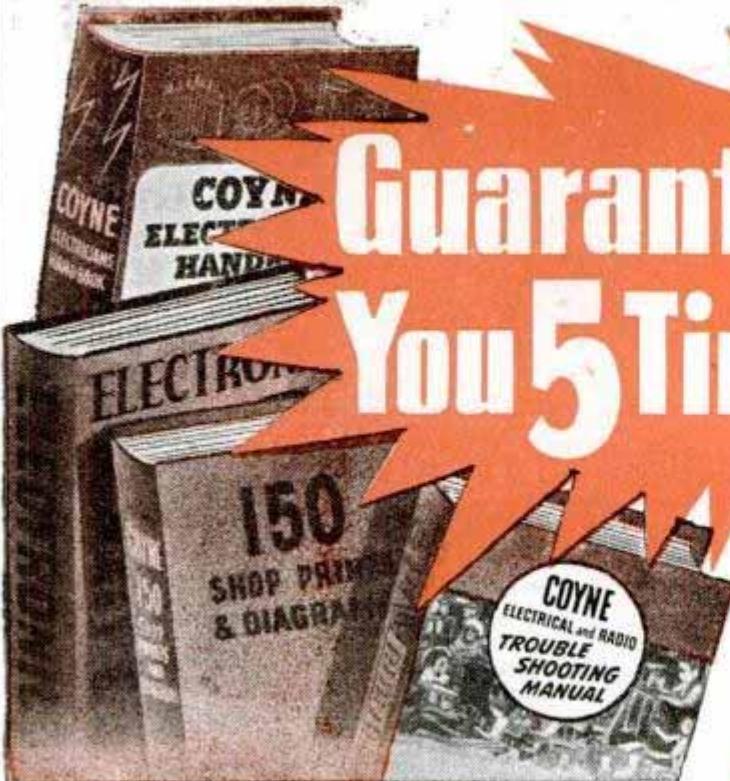
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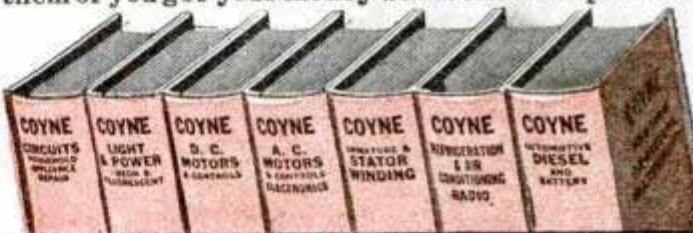


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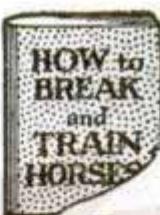
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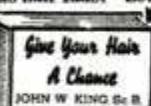
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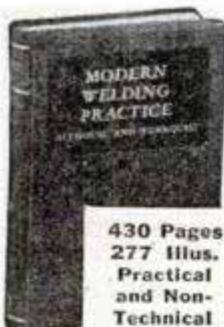
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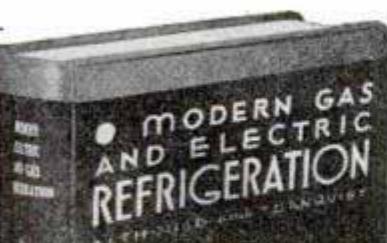
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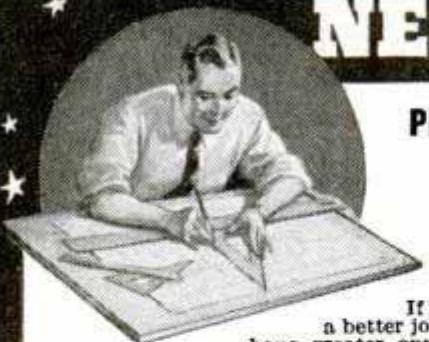
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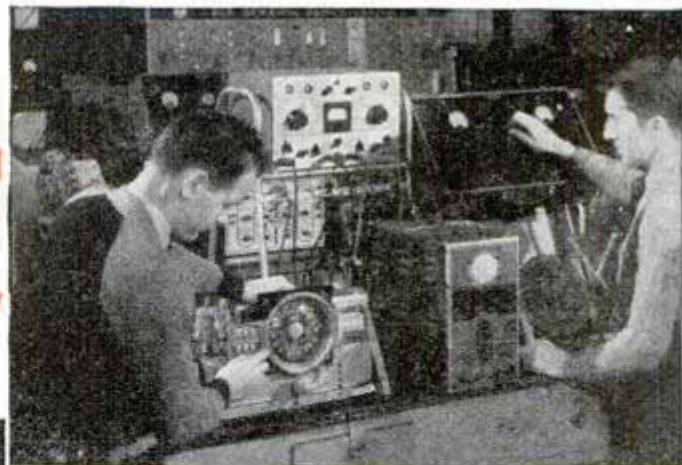
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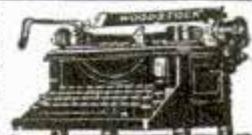
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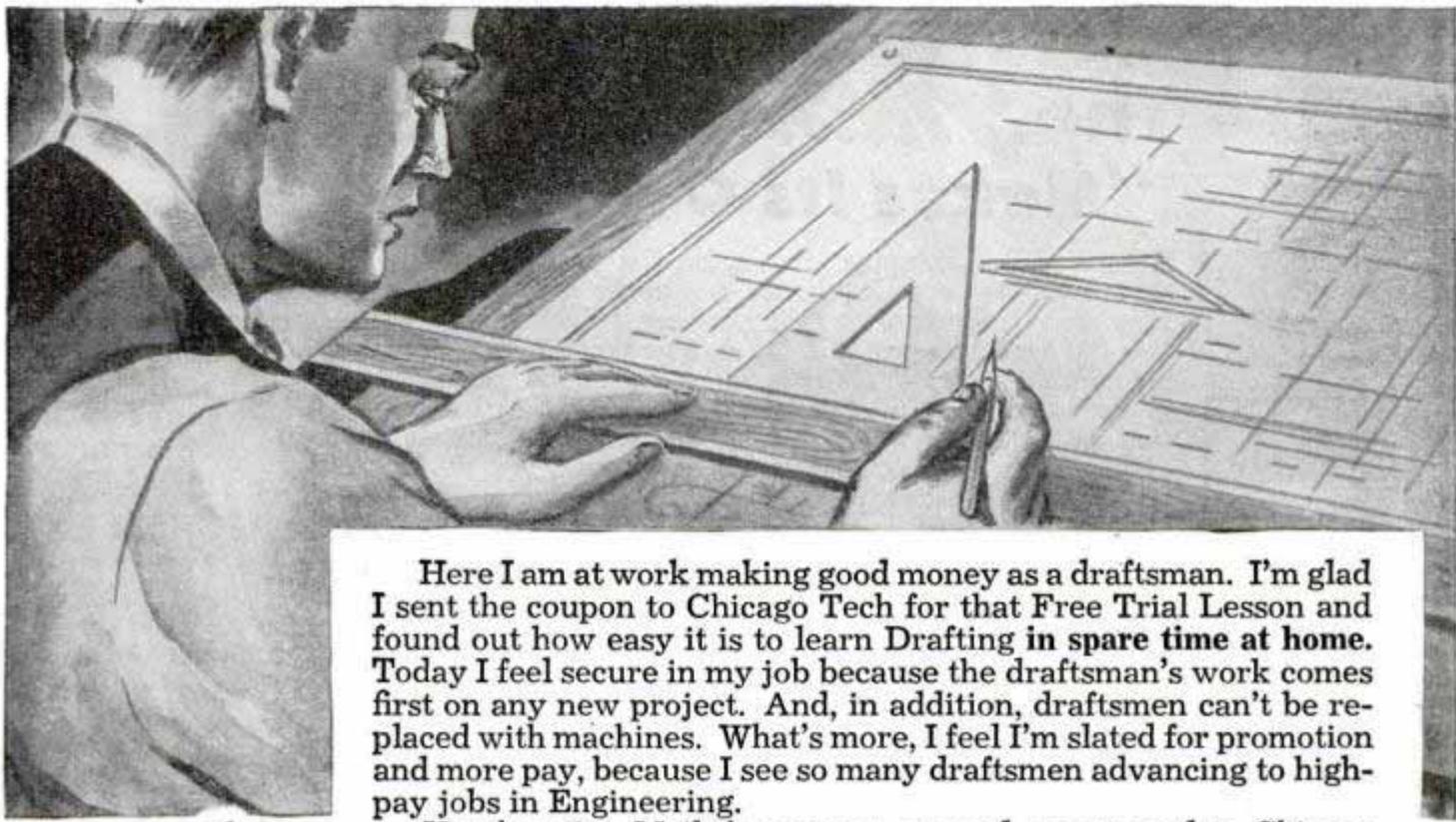
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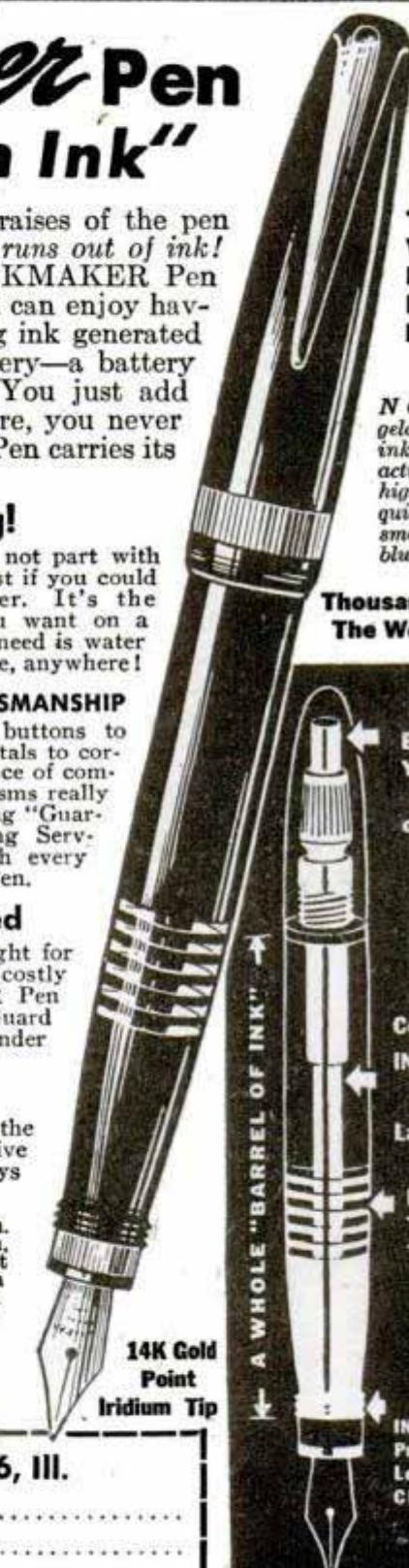
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BUILD Radio. Complete kit with tubes \$10.95. Details. Radio, 9418e Avenue "A," Brooklyn, N. Y.

RADIO Tubes, parts, condensers. Free bargain lists. Potter, 1314 McGee, Kansas City, Mo.

RADIO Service men and experimenters send stamp for our giant radio catalogue. Save dollars. United Radio Co., (1000-V) Newark 1, N. J.

RADIO Service flat rate schedules solve pricing problems. Compiled from 20 years experience. Write for information. Radio Equipment Co., 1415 W. Franklin Ave., Minneapolis 5, Minn.

FAMOUS Razor blade radio! Illustrated plans 35c. New Radio, Lohrville, Iowa.

RADIO Technician and radio service courses. Training for federal licenses. American Radio Institute, 101 W. 63 St., New York City. Approved under G. I. Bill of Rights.

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LEARN Shell jewelry manufacturing. Complete, simplified home instruction course, beautifully illustrated, shows 45 styles pins, earrings, brooches, sprays, hair ornaments. Includes pearlizing, dyeing, golding, glow-in-dark methods. No tools needed! Learn-earn within a week. Only \$1 postpaid, including wholesale prices of all raw materials. House Of Gifts, Box 4550-PP6, Coral Gables, Fla.

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BOOKKEEPERS—Operate your own "Dollar-A-Week" bookkeeping and tax service. Full or spare time. Details free. Ellis, Box 200, Cedar Grove, No. Carolina.

PROFITABLE Business right at home. Be our agent for leading magazines taking subscriptions in your spare time. Send card for supplies. American Readers Service, Gwynedd, Penna.

BUILD Mail Order business of your own—anywhere! Free illustrated prospectus on "Modern Mail Merchandising." Write at once. Mail Enterprises, Inc., 316-A Fox Building, Detroit 1, Michigan.

MAKE Flexible Molds. Statuary, Art Goods, Novelties, Artificial Marble Flooring, Liquid Marble. Literature free. Kemico, Park Ridge (1-M), Ill.

EARN Money with textile painting course. Free details. George Gundrum, LeRoy, Michigan.

INDUSTRIAL X-Ray a vast new post-war profession. Find out how to qualify. Rush name for facts. Ohio Institute of Technology, Box X-278, Greenville, Ohio.

BOOKKEEPERS: General ledger and tax report experience. Operate permanent, profitable accounting service for the smaller business. Part or full time. Simplified method. Write now! L. A. Bell, 1404 West 25th Street, Cleveland 13, Ohio.

BE Your own boss. Start at home. Amazing profits. Literature free. Ace Sales, 920A1 Cullom Ave., Chicago 13, Ill.

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SELL Books by mail. Spare time, home office. Start small, grow big. Grand opportunity to establish clean, legitimate mail order business. "How" booklet 10c. Kraft, 3114-S1 Walnut, Chicago 12, Ill.

ELECTRICAL Appliance repair. Open your own shop. Learn house wiring; electric motors, vacuum cleaners, washers, etc. Complete illustrated course shows how. Free booklet. Pacific Training School, Dept. AP-1, 4703 West Pico, Los Angeles 6, Calif.

MECHANICALLY Inclined men — Own and operate general appliance repair shop. Complete, illustrated course shows you how. Welding, refrigeration, motor repair, how to get business, etc., all phases covered. Free literature. Christy Supply, Dept. 160, 2835 N. Central Ave., Chicago.

START Advertising and letter shop. Complete low cost home training shows how. Free booklet. Pacific School, 1-B, 7217 South Broadway, Los Angeles 3, Calif.

MAILORDER Business opportunities. Details—postal. Smith, 72-E Southbourne, Boston 30, Mass.

TRADE Magazines—Classified directory 3343 business, vocational and diversion publications with addresses and subscription rates. \$1.00 postpaid. Commercial Engraving Publishing Co., 34CC North Ritter, Indianapolis 1, Indiana.

MAIL Order business course shows you how to make money, spare or fulltime. Teaches professional mail order technique—not penny-snatching schemes. Fascinating 100-page illustrated success-catalog free! Write—Nelson Company, Dept. 4-02, Chicago 5.

TREASURE Finders. See Goldak advertisement in Miscellaneous section.

WANT To sell by mail? If it's information you desire, get the facts, avoid needless risks. Absolute necessity if planning to sell by mail. Write Elco Service, 3338 Monterey, Detroit 6, Mich.

START Profitable home business in spare time. Complete mail sales campaign literature supplied. Details free. A. Riegel, 1111 Harrison, Philadelphia 24, Penna.

SELL By mail. Particulars free. Write, Frank J. Artz, 1060 Harding Drive, Toledo 9, Ohio.

POSTWAR Security! The greatest legitimate scheme ever devised to secure a big mailing list and a stream of dimes. Free particulars. Jack Killion, 7922 South Vermont Ave., Los Angeles 44, California.

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\$24,500 RICHER: Used schemes from "Schemer" Magazine, Alliance, Ohio, 48th year. \$1.00. 4 samples, 30c.

PLASTICS Guide-listing dealers in materials, molds, machines, supplies, equipment, accessories. \$1. Plastics Digest, 3937P Tracy, Kansas City 4, Mo.

LIQUID Rubber for making molds for plaster castings. Finest quality. Sample. Sure costs more worth more. \$3.00 qt. \$10.00 gallon. W. Wooley, 115-B, Donald, Peoria, Ill.

HUGE Profits, new food specialties! 5,000 word course \$2.00. Tirekop, Box N-1, Madeira, Ohio.

OPPORTUNITIES — Foreign countries. Thousands of job opportunities in many fields. Information explaining where and how to apply. Lists of hundreds of firms with foreign interests \$1.00. Industrial Trade Surveys, Dept. A-11, P.O. Box 4151, Los Angeles 24, Calif.

SELL Cosmetics by mail. Women spend millions on beauty. You can make your share of this cosmetic money. Let us show you how. Details free. Frank J. Artz, 1060 Harding Drive, Toledo 9, O., Dept. A.

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QUICK Independence and fame. Money unnecessary. Thousands strangely richer. Fascinating, easy, desirable work. Airmail dollar. Results or refund. Zigzag Corporation, Box 101, Guatemala, Central America.

EARN Steady income using table and few hand tools. Easy, pleasant work, exclusive product and rich market. Full or spare time. Industrial development service, 3006 Ridge Avenue, Philadelphia 21, Penna.

LIQUID Marble—make in any color. Soundproof plastic flooring. Flexible molds. Cast novelties, plaques, statuary. Big money—your own business. Free information. Write—Bing Products, 621-AB Tremont Street, Boston 18, Massachusetts.

RUBBER Mold making liquid make gifts, novelties, pre-war quality. Free cast-wood plastic model with sample quart \$2.95; directions. Rubbercoat, 3873 California, San Diego, Calif.

WANT To make \$100 weekly? No foolin'. Details and valuable tested business secrets, success plans, moneymaking information, 25c postpaid. Refund coupon. Rush. Wilkin, 118½-PM E. Main, Hillsboro, Ohio.

JUST Released: Liquid rubber to make molds for plaques and statues. Plastic formulas and compounds. Apex Plastic Products, 1740 Estes Ave., Chicago 26.

FOREIGN And domestic jobs, all kinds. Latest accurate information on jobs, firms and projects in U. S. and foreign countries. Mail \$2.00 to Industrial Research, Ltd., 403 Broadway Bldg., San Diego 1, Calif., for the 1946 edition of the Foreign Employment Digest. Lists the actual projects with application blanks. Costs more, worth more. 7 day refund privilege.

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BECOME A finance man. Particulars free. George Lenhoff, Lincoln 8, Nebr.

MAKE Your fortune in great new industry manufacturing and marketing products containing "DDT." Wonder-Working Insecticide. World-wide waiting market. My Ten Master DDT Formulas and simplified manufacturing and marketing instructions for starting on small capital. Rush request for full details, free. Howard Robinson, Ph.G., 1318 S. Ohio, Sedalia 10, Mo.

SIX Leading mail order publications 25c. Full of articles, plans, schemes, wholesale offers. Kraft, 3114-S1 Walnut, Chicago 12, Illinois.

BECOME A columnist. Author of textbook offers correspondence course to limited number. Circular free. Ben Arid, Box 4, Station D, Los Angeles.

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START Profitable home mail order business. \$5.00 required. Details free. Powell Service, 5713 Euclid, Cleveland 3, Ohio.

FREE Hot water the year 'round. First cost is last cost. Build your own solar water system. Average cost less than seventy dollars. Good business opportunity sell solars in your community—it's easy. Complete instructions and drawings send two dollars. Will produce hot water any locality. Miami Solar Water Co., P.O. Box 175, Coral Gables, Florida.

137 WAYS To make money, in home or office, business of your own. Full particulars free. Elite Co., 214 Grand St., New York 13.

PUBLISH—An amusement magazine in your community. No investment. Interesting and profitable opportunity. Complete instructions together with sample copy of successful magazine—\$1.00. Publisher, Box 151, Grand Rapids, Mich.

1100 BUSINESSES With limited competition, \$1. Box 1, Station C, New York.

BOOKKEEPERS Earn additional income posting at home. Barnhart & Kennedy, Public Accountants, Memorial Square, Chambersburg, Penna.

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METALLIZE Baby shoes! Learn from nationally recognized consultant. See Kushner ad on page 178.

MILLIONS Want start own business; be independent! Cash paid you for helping us reach them. Co-Operative Service, Box 253, Niagara Square Station, Buffalo, N. Y.

CASH By mail. Either sex. 10c brings offers. Bargain. Specialty Company, Box 635BO, Modesto, California.

PLASTICS Make your own at home. Formula and moulding instructions \$1.00. Box 84, Station K, Toronto, Canada.

PLASTIC Homes—build yourself! Resurface old buildings! Wonderful building material. Marbleized Service, Edwardsville, Illinois.

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TAILORED Homes—the modern plan book. Ad under heading Miscellaneous.

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CASH In on bubble craze. New miracle liquid sells like wild. Instructions, formula and source of supply of bottles, wands, labels. \$2.00 check or m.o. Benco Distributors, 276 Morris Ave., Elizabeth, New Jersey.

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MANUFACTURE Nameplates, house numbers, electric signs. Box 221, Newport News 6, Virginia.

START A home business in spare time. Make extra money. Experience not essential. Literature free. Rolf S. Iverson, Box 916A, Grand Central Annex, New York 17, N. Y.

BUILD Miracle homes. Yours. Others. Chamberlain, Fitzsimons Building, Pittsburgh 22, Penna.

ASTOUNDING Modern mailorder plan brings quick profits. Darrah, Orono, Me.

OWN A mail-order paper products business. Sell envelopes, tags, bags, boxes by mail, wholesale. Tremendous demand. Steady profits. No capital necessary. Write Omaha Envelope Service, Dept. 124, 4721 California, Omaha 3, Nebr.

SOMETHING New in small business plans. Created by a business counselor. They're tops! Particulars 3c stamp. E. Reese, 915A 30th South, Seattle.

HANDY Men—Earn money home operating community "Fix-It" shop. Write Stafford, 708 Rawlings, Carbondale, Ill.

FREE Literature. Hundred money-making ideas. Wolf's, 3240 Glenview Street, Philadelphia, Penna.

PROFITABLE Mail opportunities, pleasant, interesting. Particulars free. Reichert's, 1838 Van Buren, Cleveland 12, Ohio.

MONEY-MAKING Opportunity. Free literature. Readers' Service, 651 Peoples Building, Charleston, S. C.

HEDDEN Metal-detectors. Materials now available! We have the latest in circuit and mechanical design plus The Know How! Write for literature. Heden Metal Detectors, Box 6892, N.S. Pittsburgh, Pa.

EARN More money. Hundreds of live business and manufacturing propositions. Free booklet. Charles Service, 117 East Second Street, Girard, Ohio.

LATEX For making flexible rubber moulds. Thoroughly tested. No shrinkage. Complete instructions with each order. Stoneham Rubber Co., Box 244, Stoneham 80, Mass.

\$5,000 YEARLY Possible, selling books by mail. Distributors proposition: Nichols Publishers, Box 831, Pine Bluff 1, Ark.

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HIGH School seniors: Make good money selling our graduation name cards. Biggest commissions! Season starting. Hurry! Craftcards, Box 235(AL), Pittsburgh, Pa.

SHARPEN Scissors for doctors, barbers, housewives. Mail \$1.00 for complete instructions to Sterling Service, 1301 Porter Street, Richmond, Virginia.

HAVE An office of your own. Learn collection agency business by correspondence. Many earn \$5000-\$15,000 annually. Write for free bulletin. Franklin Publishing Company, Roanoke 7, Virginia, Dept. PM.

39,147 FOREIGN Patents, now available for manufacture. 25,000 royalty-free. 290 classifications. Information free. Patent Service Company, St. Cloud 14, Minnesota.

WANT More money—better job? Scientific way, using basic principles explains exactly how to get what you want. Details free. Kindig, 1629 Vine St., Philadelphia 3, Penna.

START Home business making statuary, plaques, novelties, garden furniture, artificial marble flooring, liquid marble. Make your own flexible molds. Amazing profits. Folder free. Creative Publishers, Box 236-L, Winnetka, Illinois.

WE Start you in business, at home, sparetime, earning \$10-\$30 weekly selling by mail. Stamp appreciated but not necessary. Driscoll Sales Service, Box 2771-A, Denver, Colo.

START Profitable home business now; capitalize spare time; free details. Manhattan House, 126 Lexington Avenue, New York 16.

IDEAS For starting to choose your own business, write to Dranichak & King, P.O. Box 310, Binghamton, New York.

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IF You'd like to make \$5,000 annually or better, in an easily learned office business of your own, send for free details immediately. G. H. Cole, Pres., Syracuse 2, N. Y.

HOW To start your own business. Write Successful Income Builders, Hollywood 28, California.

SELL Folios by mail. Small capital starts you. Send \$1.00 for sample and complete set up. Gulf Coast Industries, 209 West Keys, Tampa 3, Fla.

UNPAINTED Wall plaques 2½c up. Illustrated list free. Oman, 642 Broadway, St. Paul 1, Minnesota.

RUBBER Moulds for casting novelties. Latex for making moulds. Use thoroughly tested and approved products. Eastern Latex Laboratories, Box 153, Mattapan 26, Mass.

TREMENDOUS Profits mailing our literature. Generalprint, Cottage Place, East Orange, N. J.

FORMULAS. Opportunity plans, bargain guide, literature free. Beejay's, 518 South 30th, Lafayette, Indiana.

HOW To operate your own advertising agency profitably. brand new copyrighted manual reveals all. Learn how you can start from home, spare time with few dollars capital. No stock or equipment to buy. Earnings unlimited. Sincere folks get free details. P. Snyder, Box 4907-A, Philadelphia 19, Penna.

SPARE Time mail business earned \$1400 monthly. Copyrighted instructions \$1.00. Wm. Boyd, 331 Fourth, Pittsburgh 22, Pa.

300 TESTED Moneymakers, 62 pages, 40,000 words. Business plans, secrets, formulas, mail order plans. Wholesale suppliers. Now, you get—not just one plan—but all for only 25¢ postpaid. Start now, no waiting for free details costing \$1 to \$15. Money returned if dissatisfied. F. Larson, Galetton, Penna.

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NEW Flexible mold material, casts catalin plastic, concrete, plaster, in same mold. Literature. Sanflex, Box M, Clyde, Ohio.

LEARN Profitable credit-collection agency business; earn \$5,000-\$10,000 upwards annually; sparetime opportunities excellent; postcard brings interesting literature free. Write: Educational Extension Service, Department 101, Los Angeles 36.

START Big money business on shoestring. New, successful cleaning service. Big demand everywhere. Easy, quick profits. Write for details. Americlean, 211 N. 7th St., St. Louis 1, Mo.

MAIL Order beginner's "Business Development Plan," "Profitable Mail Selling Idea," "Pointers Along the Mail Order Trail" show how to make mail order business pay! All three, in 10,000-word treatise, postpaid quarter. Satisfaction guaranteed. Maupin & Maupin, LaFayette 3, Indiana.

FLORIDA Opportunities—Pensacola offers exceptional opportunities for small industries, especially in the field of mahogany novelties and woodware, perfumes, soap, chemicals. Delightful year-round climate. Wonderful fishing, hunting, beach sports. For information write: Industrial Development Division, Municipal Advertising Board, Pensacola, Florida.

BUILD Own business mailing penny post cards; six profitable plans with information for starting. Gordin Publishers, Box 23, Pawtucket, R. I.

"HOW To Finance Any Business, Obtain Capital." Research, Aitkin 5, Minn.

"HOW To Make Simple Molds and Plaster Plaques." Profitable business or hobby! Instructive booklet 25c. Plastercraft, 1406 East 43rd Street, Cleveland 3, Ohio.

"10,000 ALASKA Fishing jobs." Alaska's largest industry regularly employs thousands of men and women in seafoods production. Possible earnings up to \$5,000 in few weeks. Authentic 7,000-word copyrighted report gives job information, union requirements, sample application letter, names and addresses over 40 Alaska fisheries. Newest edition includes similar information on California, Oregon and Washington fisheries. Vital facts for immediate application in a permanent industry. \$1.00. 7-day refund privilege. Pacific Industrial Research Bureau, Dept. PM-9, 202 Studio Building, Portland 5, Oregon.

MAKE And mold genuine plastics. Forty illustrated work-sheets explain methods, processes. Authentic-simplified \$1. Free circular. Plastics Digest, 3937B Tracy, Kansas City 4, Mo.

START Profitable sideline business now! Complete free details and premium offer available. Write Sheboygan Publishing Co., Sheboygan, Wisconsin.

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\$25 WEEKLY Working two hours daily. No canvassing. No manufacturing. Lycke, Box 2471, Cleveland 12, Ohio.

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QUICK Money! "Repairing Car Batteries." At home. Easy too. Write Batterymen, 901 South Avenue, Grand Junction, Colo.

START Mailorder bookshop—Everything furnished; publisher cooperation. 25¢ brings booklet, exclusive setup, samples, exciting ideas. General Publications, Ossining, N. Y.

BECOME An "Attritionist Masseur." First improvement over Swedish massage in 100 years! Results unbelievable! Dr. Swearingen, 9128M, Station S, Los Angeles.

COLORGLAZEL Concrete pottery made without molds. New, low cost, patented method. Cemetery products, novelties, tiles, floors, etc. Basement leaksealing. Other moneymaking projects. Booklet, details free. Men only. National Pottery Company, Fergus Falls, Minnesota.

BIG Money making Hollywood style pottery, bird baths, wishing-wells, benches, stucco-rock. New method. Clever designs. Color with chemicals, water-paints. Marbling, colored glaze effects. Dime brings samples, pictures, literature. Hollywood Cementcraft, 8527 Wonderland Ave., Hollywood 46, California.

\$—RAISE Giant Chinchilla rabbits. Willow Farm, R 15A, Sellersville, Penna.

HOW And where to obtain capital. Fully explained. Particulars free. Star Service, Wapakoneta, Ohio.

AGENTS To mail our literature. Good profits. Home business. Maywood, 1133 Broadway, New York.

RAISING Canaries pays good profits. Valuable bird book—"Its Care, Breeding and Training." Price \$1.00. American Canary, 2839 N. Halsted, Chicago.

LIQUID Marble; snow-white, multi-colored. Glazed. Unglazed. Composition flooring. Lifetime wear. Any color. No priorities. Flexible molds. Plaster casting. Get into the big money now. Full information given free. Write Compo-Tex, Box 786-R, St. Louis, Mo.

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YOUR Own business—As little as \$100 starts you now! No training needed! See our ad on page 180. American Photocopy Equipment Co., 2849 N. Clark St., Dept. GF16, Chicago, Ill.

MONEYMAKING OPPORTUNITIES

MECHANICALLY Inclined men — Own and operate general appliance repair shop. Complete, illustrated course shows you how. Welding, refrigeration, motor repair, how to get business, etc. all phases covered. Free literature. Christy Supply, Dept. 1160, 2835 N. Central Ave., Chicago.

BOOKKEEPERS — Interested in more money spare time. Postwar opportunity. Journey, 1003 Fourth, Orange, Texas.

READ "How to Go into Business for Yourself." 64 pages of eye-opening information. Rush one dime. George A. Simon, 6843 Jonathon, Dearborn, Mich.

"HOW To Make Money with Big Mails" booklet 25c. Frank J. Artz, 1060p Harding Drive, Toledo 9, Ohio.

EARN Money at home! 64 page "How" book—25c. Money-making propositions, home work offers—free. Random Company, Box 2688K, Los Angeles 28.

EXTRAORDINARY Mail order ideas and opportunities, 10c. Thomason, 857M East Jessamine, Fort Worth 3, Texas.

MAKE Liquid Marble. Plaster Plaques, Statuary. Instructions, formulas, \$1.00. Ideal Service, 179-M, Park Ridge, Ill.

TREASURE Finders. See Goldak advertisement in Miscellaneous section.

FASCINATING Mailorder legitimate plans, schemes. Nearly all profit. Particulars, stamp. Warco, Freeland, Mich.

HOW To make and sell novelty barometer ornaments. \$1.00 postpaid. Gerald McNeely, 3044 Jackson Blvd., Chicago 12, Illinois.

MAKE Fast-selling novelties with colorful plastics! Free details. Beginner's jewelry kit and instructions, \$1 (refundable). Plastic Works, 712 Kimball, Danville 3, Illinois.

GET Into Moneymaking business. New, used Army, Navy wearing apparel, equipment. Big demands—big profits. Famous Jobbing Company, 566 W. Roosevelt Road, Chicago 7, Illinois.

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START Your own business! Big money manufacturing novelties, plaques, statuary. Details free. Write—Bing Products, 621-AC Tremont Street, Boston 18, Mass.

\$1 MATERIAL Brings \$20.00. Unlimited possibilities with concentrate cosmetics. 50c value sample 10c. Money back. Kohen, 506 W. 45th, Chicago 9.

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THOUSANDS Articles wholesale. "Supply Source Directory" 10c. Ideal Service, D-1, Park Ridge, Ill.

ONLY \$1.00 For complete illustrated instruction book to make shell jewelry with materials for pins. Free catalog of supplies on request. All shells 10c pkg. except Miss. gars, Baby Conch 15c. Collectors specimens. Woods Shellecraft, Box 306, Bradenton, Florida.

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GIGANTIC Mails—trade magazines—name listed 25c. Jackson, Newfoundland 3, Kentucky.

MONEY Made office, home or room. 10c brings envelope opportunities. Bargain Specialty Company, Box 635C, Modesto, California.

WE Sold thousands, so can you. Practical plastic novelties. Proven designs, blueprints, instructions \$1.00. Freeman, 41 Locust St., Yonkers, N. Y.

10c BRINGS You lots of mail. Catalogs, magazines, money making ideas, samples. Gardenville Publishers, Gardenville 1, N. Y.

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MAKE Money by mail at home. Send stamp for our special after-Xmas offers! Gravely Enterprises, Box 1654, Baltimore 3, Md.

PROFITABLE Mail order (local) business in your home. Stamp brings literature describing 125 proven plans. Kessler National Service, Box 392-PMJ, Indianapolis 6, Ind.

FREE Literature. 200 moneymaking ideas. No investment required. Send postcard now. Lynch, 402-PM Hazlett, Baltimore 29, Md.

LEARN Battery repairing, rebuilding. Engineer offers money making methods. Battery Bureau, 2225 North 44th St., Milwaukee, Wis.

EARNINGS \$2,000 Year easy; inventing simple items for special cash markets. Ideas only. No patents. Write, Hendrickson, Argyle 7, Wisconsin.

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OUR List of names and addresses of 800 ladies who delight in beautiful homes and lovely flower gardens using mail order since October 1945 will make you money. Price \$5.00. Sheigin Mailing Agency, Athens, Texas.

BIG Profits. Manufacture custom arch supports. Jul Corssen, 2638 Geyer, St. Louis 4, Missouri.

RECEIVE Giant mails, latest money-making home work offers, opportunities, magazines. Your name listed 10c. New Age Enterprises, 578-A Prospect, New York City 55.

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WHOLESALE Catalog, directory 10c. Hundreds of thousands articles. Stafford, Sunnyside-PM, Indianapolis 44, Ind.

YOUR Big mail order opportunity—No time has ever been as good as right now. Get your start right. Let me show you how, what to sell and who will buy. Big profits, easy work at home. Write: H. S. Smith, 3139A So. Mabett Avenue, Milwaukee 7, Wisconsin.

MONEymaking Books. Free list. Journal booklet, 25c. Underhill, Beebe, Arkansas.

THOUSANDS Of alarm clocks need repairing. Jewelry stores swamped. Our simplified course teaches you how to repair these clocks. Necessary tools and supplies furnished with course. Alarm Clock Repair Service, Dept. B, P.O. Box 1983, Houston, Texas.

START Profitable collection agency business; office; home; sparetime. Earn \$5,000-\$10,000 upwards annually. Investigate Educational Extension Service advertisement under Business Opportunities.

PUBLISH Your own magazine. Handsome 52 page format, well edited, illustrated. Cost low as \$1.00 month. Brings you prestige, profits. 25c brings sample details. National, Ord. Nebr.

\$—RAISE Giant Chinchilla rabbits. Willow Farm, R 15B, Sellersville, Penna.

I MAKE Big money in the mail-order business. You can do the same at home with my copyrighted system. Write me. I'll tell you how. F. Little, Box 8, Glenshaw P.O., Pittsburgh, Penna.

LEARN Metascience. Remarkable drugless healing. No manipulation. No apparatus. Unbelievable simplicity and results. Inexpensive correspondence course. Write Metascience, De Land, Florida.

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FORMULAS, PLANS, ETC.

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GASOLINE Gas machines, 30c rates, plans \$1.00. Ideal Specialties, Lakewood 5, Rhode Island.

MANUFACTURE Paints. No equipment capital needed. Complete instructions, formulas, \$2.00. Industrial Chemist, 1826-Y 60th, Kenosha, Wis.

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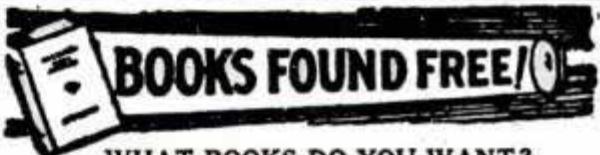
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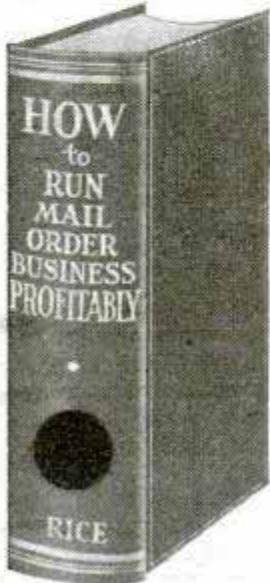
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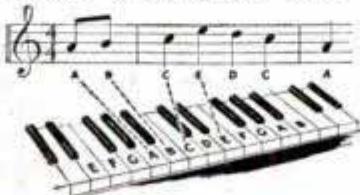
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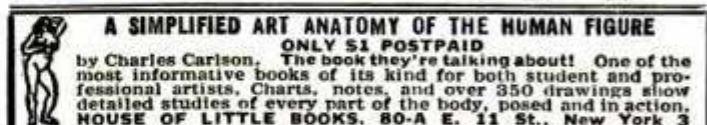
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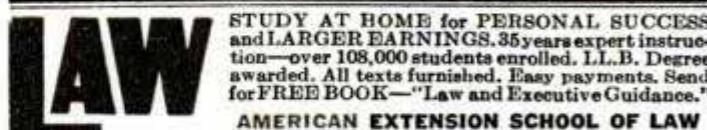
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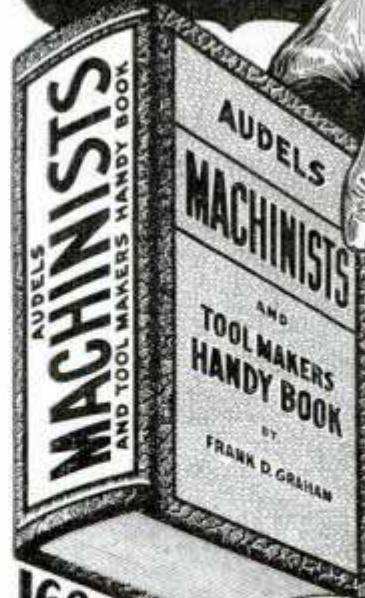
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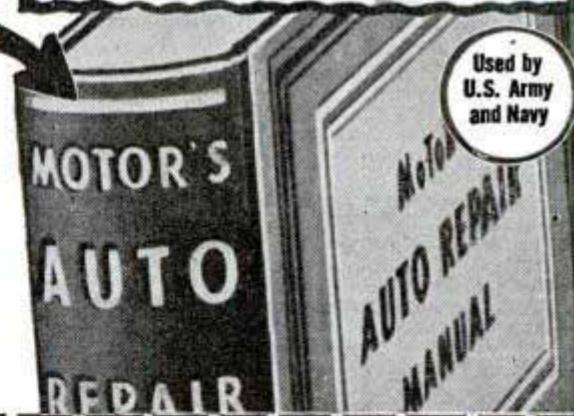


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Men now in the Army who reenlist before February 1 will be reenlisted in their present grade. Men honorably discharged can reenlist within 20 days after discharge in the grade they held at the time of discharge, provided they reenlist before February 1, 1946.

There's a long list of attractive reenlistment privileges in the new Armed Forces Voluntary Recruitment Act of 1945. The ability to keep your present grade is only one of them, but this privilege expires on January 31.

There are plenty of other reasons why many thousands of men have enlisted, and more thousands are enlisting every day. You'll certainly want to know all of the opportunities open to you. If you'll read them carefully, you'll know why a job in the new peacetime Regular Army is being regarded today as "The Best Job in the World."

PAY PER MONTH—ENLISTED MEN In Addition to Food, Lodging, Clothes and Medical Care

	Starting Base Pay Per Month	MONTHLY RETIREMENT INCOME AFTER: 20 Years' Service	30 Years' Service
Master Sergeant or First Sergeant . . .	\$138.00	\$89.70	\$155.25
Technical Sergeant . . .	114.00	74.10	128.25
Staff Sergeant . . .	96.00	62.40	108.00
Sergeant . . .	78.00	50.70	87.75
Corporal . . .	66.00	42.90	74.25
Private First Class . . .	54.00	35.10	60.75
Private . . .	50.00	32.50	56.25

(a)—Plus 20% Increase for Service Overseas.
(b)—Plus 50% if Member of Flying Crews, Parachutist, etc.
(c)—Plus 5% Increase in Pay for Each 3 Years of Service.

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Popular Mechanics Magazine

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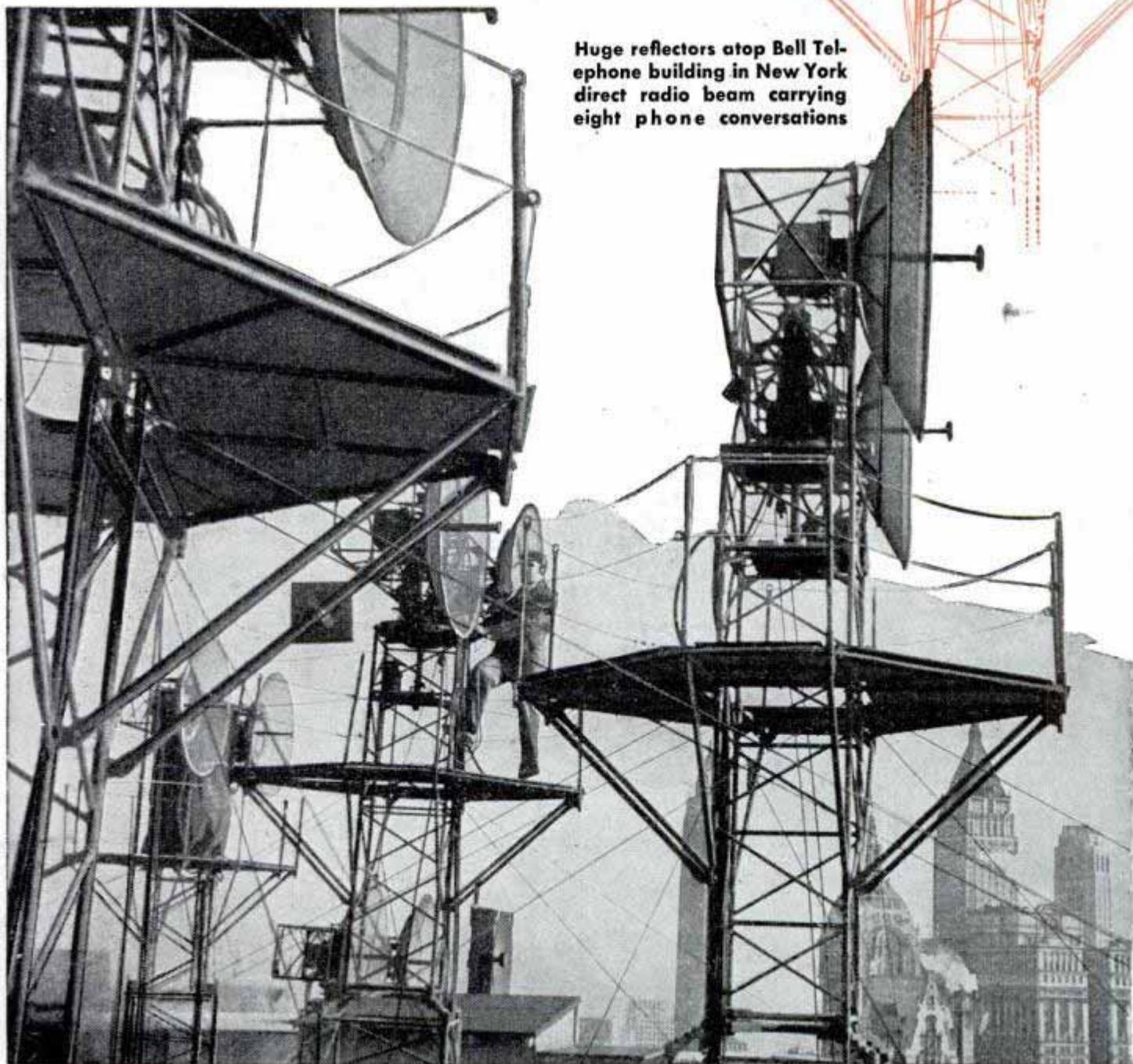
Long Distance by Short Wave

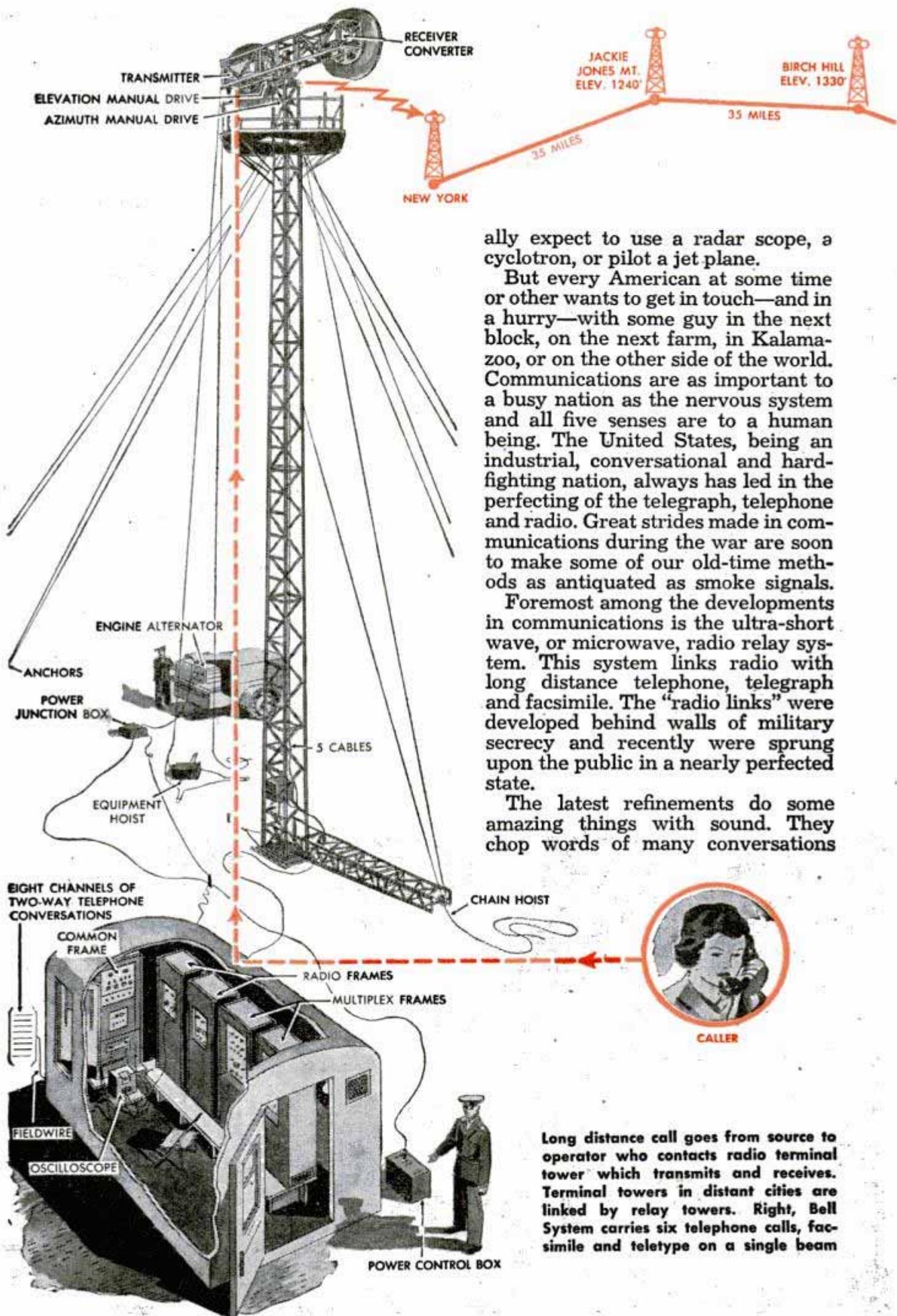
By Wayne Whittaker

MILLIONS of words have been printed about the war-developed wonders that are going to revolutionize our lives. Radar. The smashed atom. Jet propulsion.

However, few persons in their everyday life actu-

Huge reflectors atop Bell Telephone building in New York direct radio beam carrying eight phone conversations





ally expect to use a radar scope, a cyclotron, or pilot a jet plane.

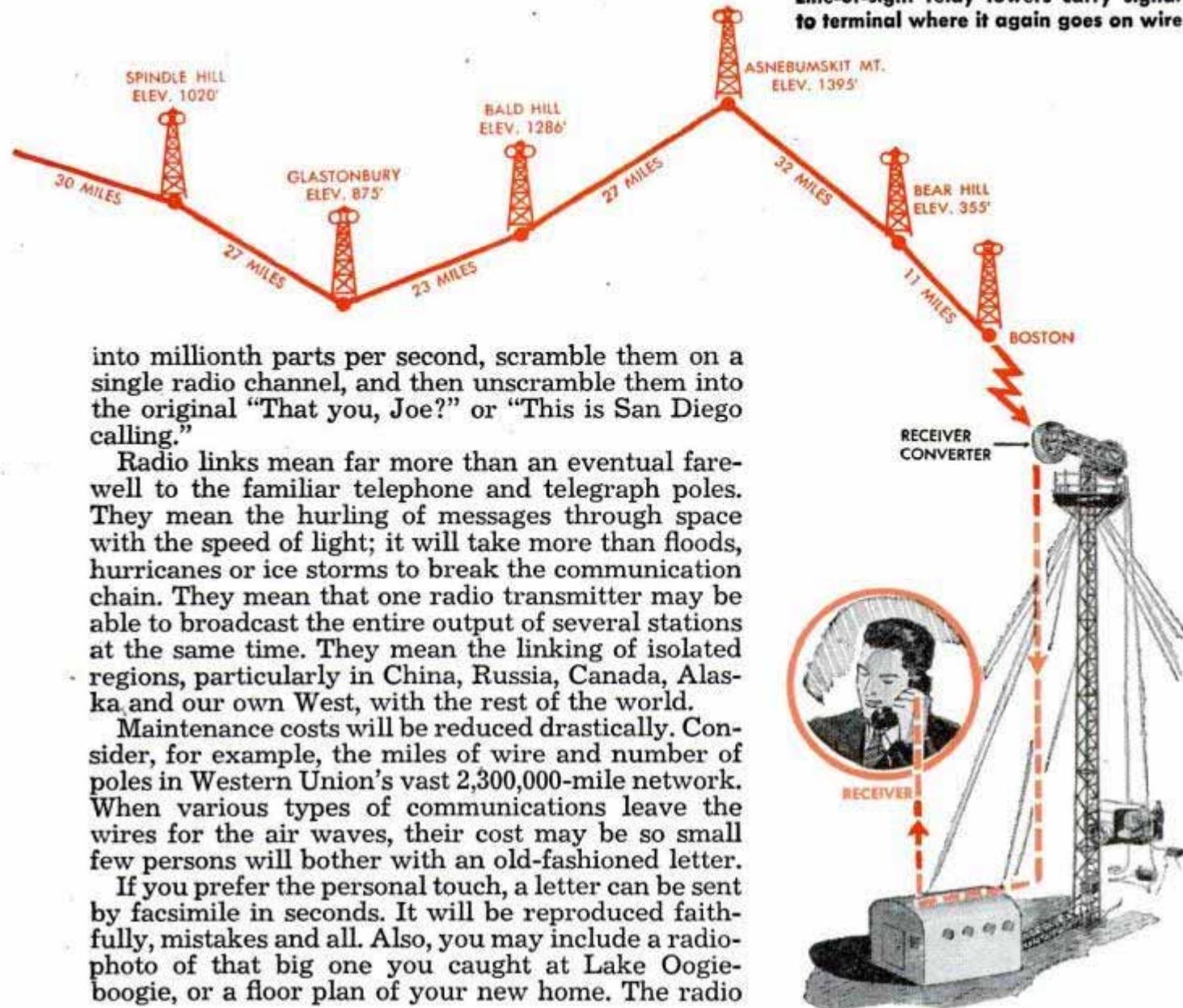
But every American at some time or other wants to get in touch—and in a hurry—with some guy in the next block, on the next farm, in Kalama-zoo, or on the other side of the world. Communications are as important to a busy nation as the nervous system and all five senses are to a human being. The United States, being an industrial, conversational and hard-fighting nation, always has led in the perfecting of the telegraph, telephone and radio. Great strides made in communications during the war are soon to make some of our old-time methods as antiquated as smoke signals.

Foremost among the developments in communications is the ultra-short wave, or microwave, radio relay system. This system links radio with long distance telephone, telegraph and facsimile. The "radio links" were developed behind walls of military secrecy and recently were sprung upon the public in a nearly perfected state.

The latest refinements do some amazing things with sound. They chop words of many conversations

Long distance call goes from source to operator who contacts radio terminal tower which transmits and receives. Terminal towers in distant cities are linked by relay towers. Right, Bell System carries six telephone calls, facsimile and teletype on a single beam

Line-of-sight relay towers carry signal to terminal where it again goes on wire



into millionth parts per second, scramble them on a single radio channel, and then unscramble them into the original "That you, Joe?" or "This is San Diego calling."

Radio links mean far more than an eventual farewell to the familiar telephone and telegraph poles. They mean the hurling of messages through space with the speed of light; it will take more than floods, hurricanes or ice storms to break the communication chain. They mean that one radio transmitter may be able to broadcast the entire output of several stations at the same time. They mean the linking of isolated regions, particularly in China, Russia, Canada, Alaska and our own West, with the rest of the world.

Maintenance costs will be reduced drastically. Consider, for example, the miles of wire and number of poles in Western Union's vast 2,300,000-mile network. When various types of communications leave the wires for the air waves, their cost may be so small few persons will bother with an old-fashioned letter.

If you prefer the personal touch, a letter can be sent by facsimile in seconds. It will be reproduced faithfully, mistakes and all. Also, you may include a radio-photo of that big one you caught at Lake Oogie-boogie, or a floor plan of your new home. The radio



relay system also accommodates television and teletype, and can be used to operate business machines by remote control.

Radio relay operates like a relay race with runners stationed at set intervals. The runners carry a short stick which they pass along to the next man in the relay chain. This stick might be compared with the message that is "handed" on from one radio tower to the next, and finally to the terminal tower where it is transferred to the wires that lead to the telephone in your home or office.

More than one runner is used in the relay race because one man's breath would not hold out for the long distance. More than one radio relay tower is used because the radio microwave runs out of "breath" when it reaches the horizon and shoots off into space. These radio frequencies behave like television beams and travel in a straight line instead of following the curve of the earth like ordinary radio waves.

The Bell Telephone Company is building its first radio relay route from New York to Boston. This experimental project consists of two terminals and seven relay stations. The 50 to 70-foot relay towers are located on hills about 30 miles apart and ranging in elevation from 335 to 1395 feet. Terminals are atop the Long Lines Building in New York and the Bowdoin Square Building in Boston.

The sites were selected carefully to allow for line-of-sight transmission of the sharp beams from station to station. The microwaves are about a hundred times higher in frequency (or shorter in wave length) than very-high-frequency waves.

At these extreme frequencies, reception is immune from disturbances of lightning, static or electrical interference which might be caused by anything from a streetcar to a power line. Reflectors point the beam directly toward the receiving antenna. The beam is so sharp that speech is entirely lost if the receiver is turned two or three degrees to one side or the other. Maximum distance for satisfactory performance between any two relay stations is about 100 miles.

As far as John Q. Public is concerned, the placing of a long distance call via radio links will be done in the conventional way. The revolutionary procedure starts when the long distance operator puts his call on a field wire which carries it to the proper radio terminal. Here his voice will be chopped up and its channel placed with a group of others for transmission. The entire group of channels is called a "frame." The Bell system provides for eight two-way conversations.

This system of transmission, which differs radically from ordinary radio, is known as pulse-position modulation. This simply means that the signal is broken down into various time periods. The time-division signal starts with a "reference" pulse of energy followed by eight time periods—one for each channel. These time periods, accurately controlled by engineering genius, are shorter than the human mind can conceive. Speech is transmitted in millionth-second bits.

The frame of eight channels of chopped up sound is received at a terminal tower. There the different pulses are switched to eight different receiving circuits. The magic of electronic gateway arrangements makes sure that a particular channel pulse always enters its own circuit. Instead of being garbled or distorted, as logically might be expected, the resulting speech or other sound is unusually clear. The electronic tubes which accomplish these wonders are said to do the work of more than 50 ordinary vacuum tubes. An electron beam inside of them can be made to rotate 8000 to 30,000 times a second.

The Bell system also is introducing other aids to communication. One in the field of radio is telephone service between

(Continued to page 162)

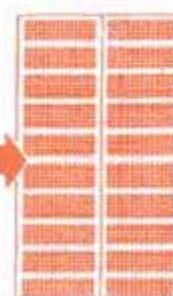
LOCAL DIAL EQUIPMENT

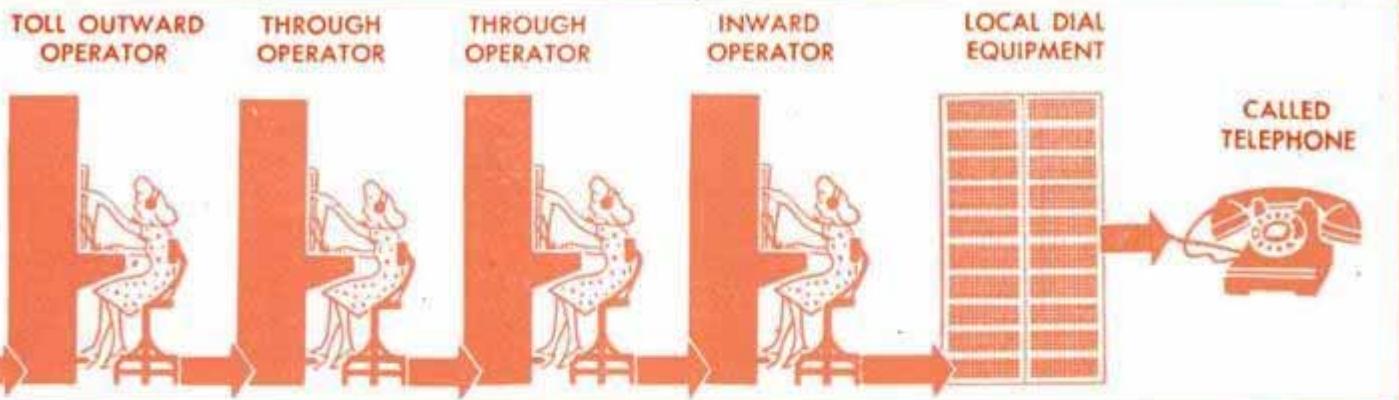
CALLING TELEPHONE



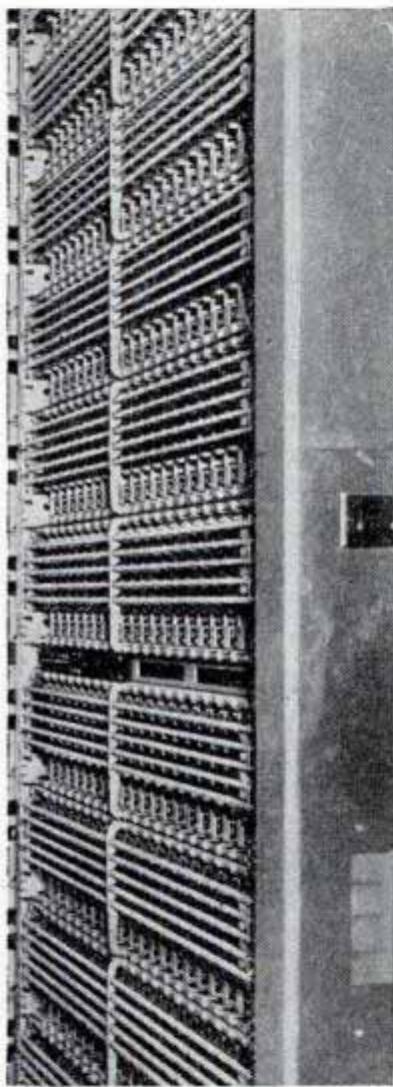
LOCAL DIAL EQUIPMENT

CALLING TELEPHONE



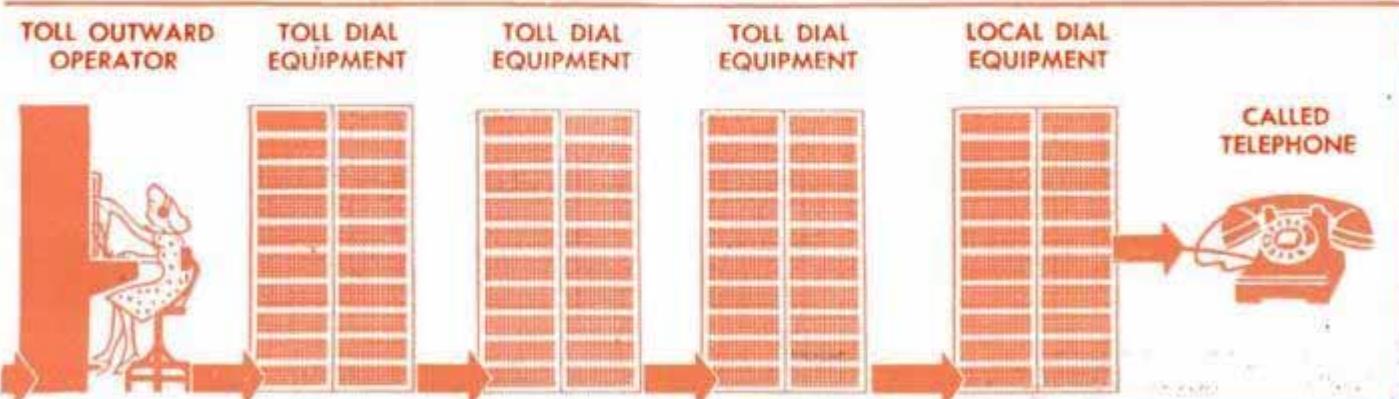


Present toll system requires several long distance operators; new dial system is shown at bottom of page



Bell Telephone System photos

Crossbar switches (left) link the long distance dial system so that the operator above can put a call through directly to a telephone in a home or office thousands of miles away. The operator sets up the call on keys which list special codes and routes. Her position in the long distance circuit is indicated in the sketch below



Fuel Saver Fits in Heating Stove to Burn Oil Efficiently

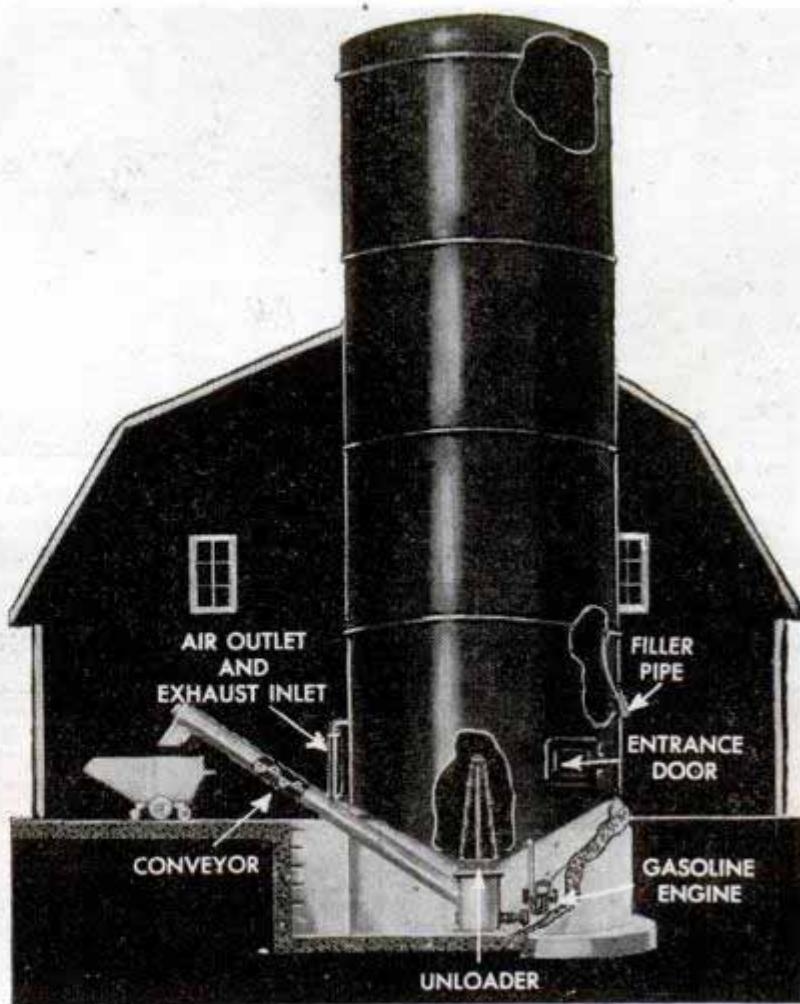


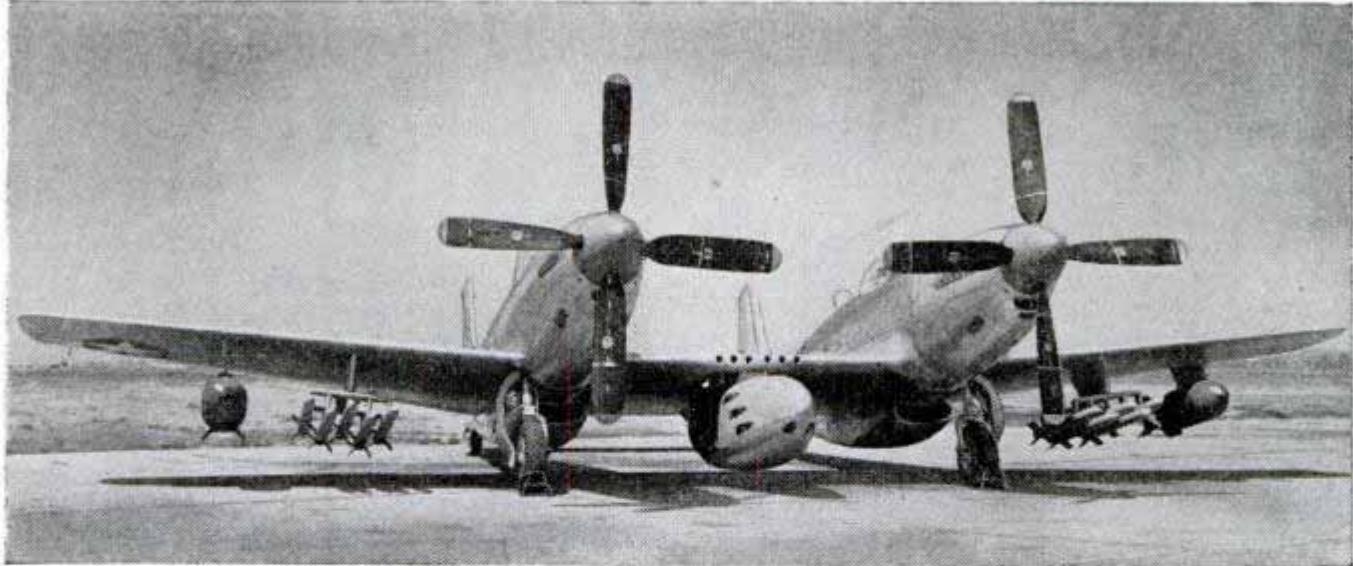
Fuel savings up to 35 percent were recorded in laboratory tests with a small cast iron decarbonizer that fits into the firepot of most heating stoves. Resembling a small table lamp, the bottom of the fuel saver contains a metallic cartridge which, when heated, emits oxide gas. This gas rises into a canopy above the base of the device where it mixes with low combustible gases from the fuel, which then are diverted to the sides of the firepot and consumed. It is claimed that use of the fuel saver results in complete combustion of the fuel oil and virtually eliminates formation of soot and carbon.

Manufacturers of commercially available products described in Popular Mechanics are listed in the Where-to-Buy-It Index, page 8A. Should you desire additional information on other articles in this magazine, a letter to our Bureau of Information will bring a prompt response with whatever knowledge we have that may prove helpful.

Silo Made of Glass and Steel Has an Automatic Unloader

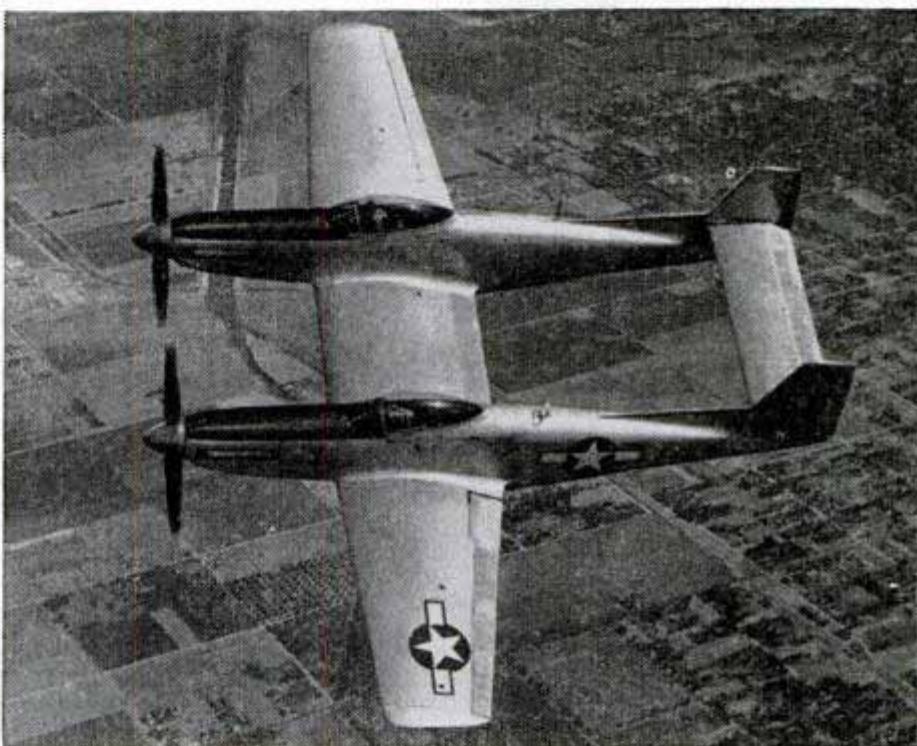
Coated inside and out with glass, an experimental steel silo near Beloit, Wis., erected after consultation with University of Wisconsin agricultural engineers, is reported to keep silage fresh in much the same manner that glass jars preserve food. The structure, being airtight, prevents the formation of molds by keeping out oxygen. In addition, the silo has two labor-saving features in its automatic unloader, which does away with climbing to the top of the silo and pitching the silage down by hand, and its built-in filler pipe. The unloading mechanism, installed at the bottom, operates on the principle of a furnace stoker and utilizes an agitator mast to loosen the silage and a feed screw to deliver it into a wagon or wheelbarrow. A six-horsepower engine furnishes power for the unloader. The built-in filler pipe eliminates the labor of erecting and dismantling usually necessary each season. The exterior, of dark blue glass, requires no painting.



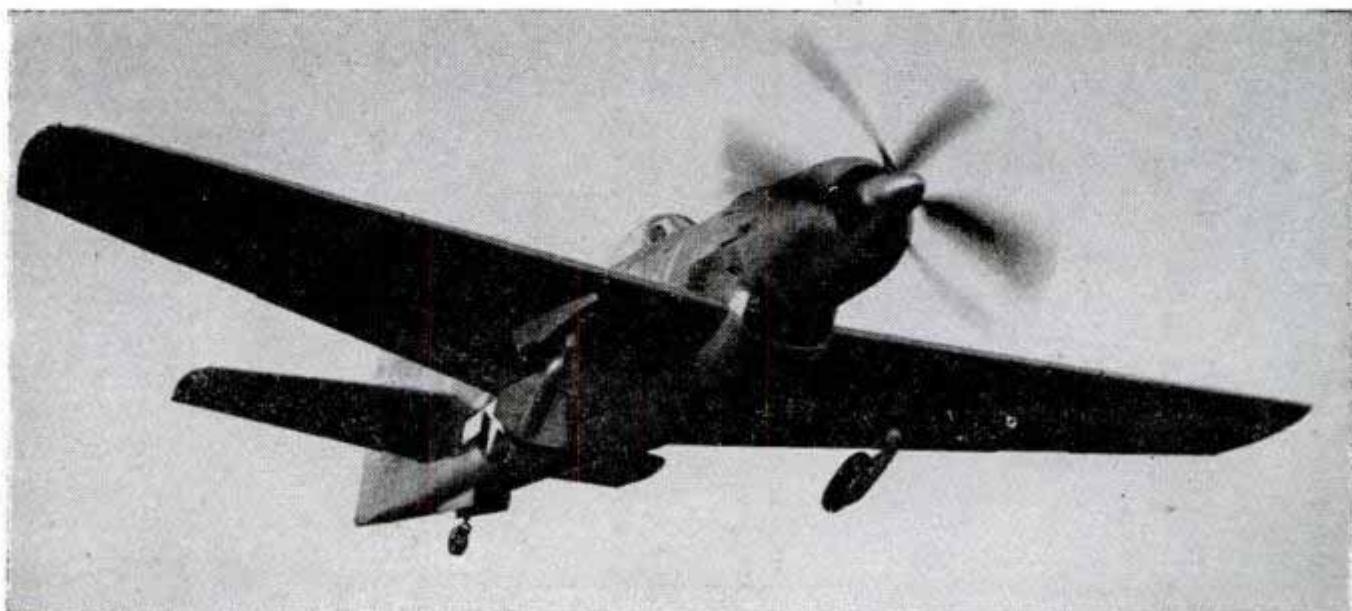


Fighter Planes That Missed The War

Too late for World War II are the P-82 Twin Mustang (top and center) and the XF8B-1 (bottom). The 475-mile-an-hour twin-fuselaged P-82, built by North American Aviation, consists of two modified P-51 Mustangs joined by a common wing, elevator and stabilizer. The pilot flies in the left-hand cockpit and the co-pilot in the right. It can carry radar for night fighting. The single-engine XF8B-1, built for the Navy by Boeing Aircraft, serves as a fighter, torpedo plane, bomber, or attack plane. After dropping a 6400-pound bomb load, it can travel over 450 miles per hour. It has contrarotating propellers driven by a

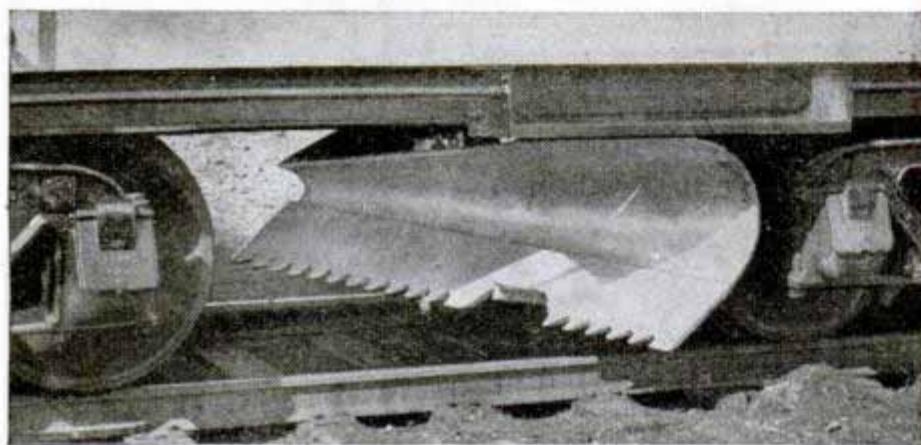


Pratt and Whitney engine which develops 3600 horsepower. Armament consists of six 20-mm. cannon mounted in the wings and sighted by remote control.





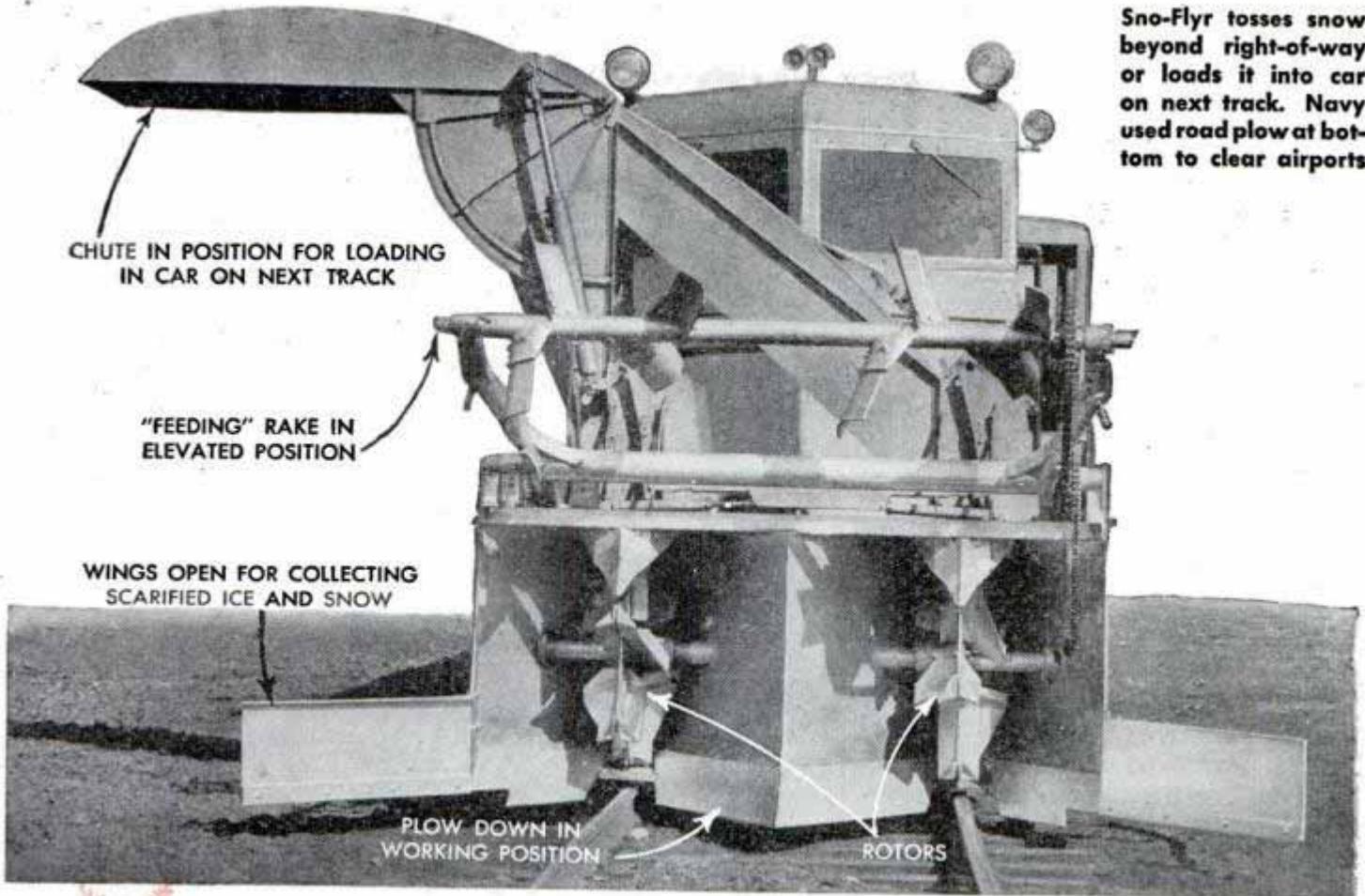
Beneath the cab of the snowplow is an ice scarifier (seen in closeup below) which is lowered to the rail to cut away ice and snow on either side



Brother of the rail plow, the highway model eating into a deep drift below can fling a plume of snow 125 feet. Many were built for the Army

**SNOW
EATER**

A large, bold title "SNOW EATER" is displayed in black capital letters. The letters are partially obscured by stylized, red, snowflake-like graphic elements that appear to be blowing across the page, suggesting motion and cold.



Sno-Flyr tosses snow beyond right-of-way or loads it into car on next track. Navy used road plow at bottom to clear airports

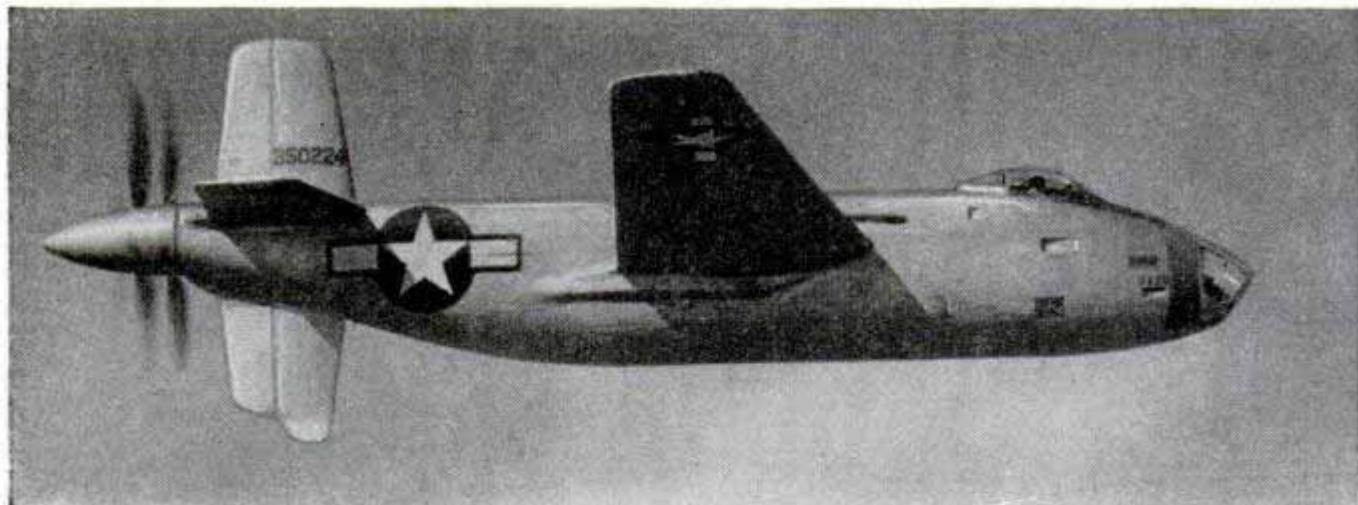
LAST winter 18,000 railroad cars carrying vital war material and perishable goods to the East Coast were tied up for weeks in the "snow belt" of northern New York State. Thousands of hours and dollars were lost. To fight this white menace to railroad traffic, a new snowplow has been developed that moves tons of the stuff per minute and can do the work of battalions of men.

The Sno-Flyr rotary plow, built by the William Bros Boiler & Manufacturing Co. of Minneapolis, is mounted on a car with two 100-horsepower gasoline engines and an enclosed two-man cab. The engines drive two multiple-vane rotors on the front. These rotors throw snow and loosened ice, conducted to them by the nose-type plow and gathering side wings, as far as 125 feet. Snow from both rotors can be conducted through a removable metal chute to deposit the icy cargo on flat cars or clear of the tracks.

An outstanding feature of the Sno-Flyr is a rail ice cutter, or scarifier-flanger, a wedge-shaped device mounted midway between the car trucks. It forces steel teeth into the ice between the rails and over the ties, moving loosened ice outside the railroad ties.

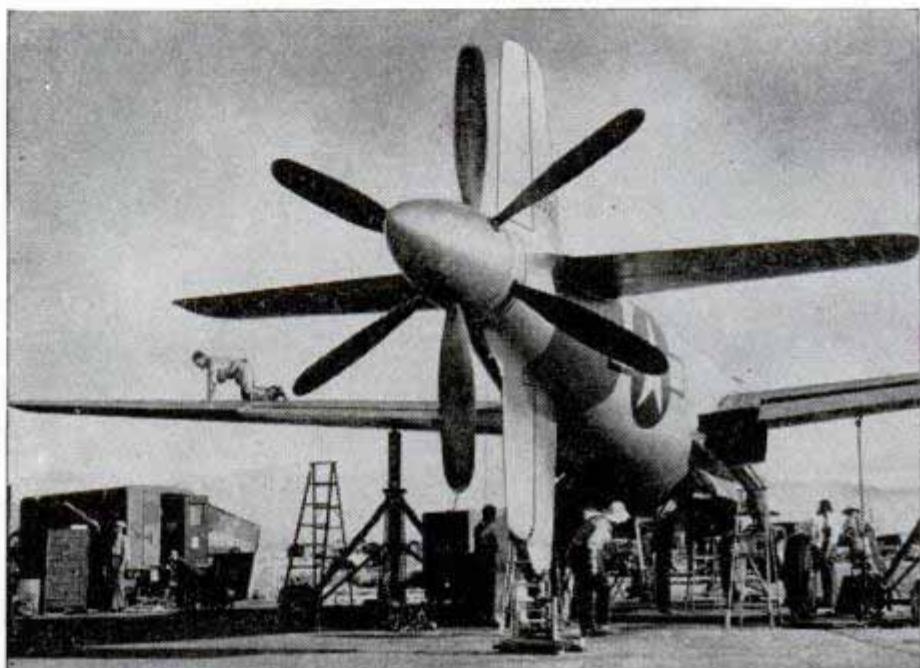
When the plow, which is pushed by a Diesel or steam locomotive, is backed up and again brought forward, this loosened ice is collected by the side wings on the front of the plow. Another feature is a rotating feeding rake that extends forward to break up chunks of snow and ice. A highway model can be attached to a truck for clearing roads or airports.





400-M.P.H. "Mixmaster"

On the AAF top secret list for two years, the Douglas XB-42 bomber will be known as the DC-8 in its transport version. This two-engine plane, which has unconventional contrarotating co-axial propellers in the rear, is the postwar successor to the familiar DC-3 known as the "work horse of the air lines." The Army version was said to be the first bomber in the 400-mile-an-hour class, and the DC-8 offers a 50-percent increase in cruising speed over the DC-3. It will carry twice the pay load. The DC-8's Allison liquid-cooled engines have a takeoff rating of 1820 horsepower with water injection. The engines are buried in the fuselage aft of the cockpit. The propellers are driven independently and either can be feathered in flight



while the engine is repaired. Elimination of engines, nacelles and propellers from the wings not only reduces drag but adds to the comfort of the passengers. The DC-8 has a wing span of 110 feet 2 inches, is 25 feet 9.5 inches high and 77 feet 10 inches long. It weighs 39,500 pounds at takeoff.

Versatile Farm Jeep Tows Corn Binder With Motor Providing Power

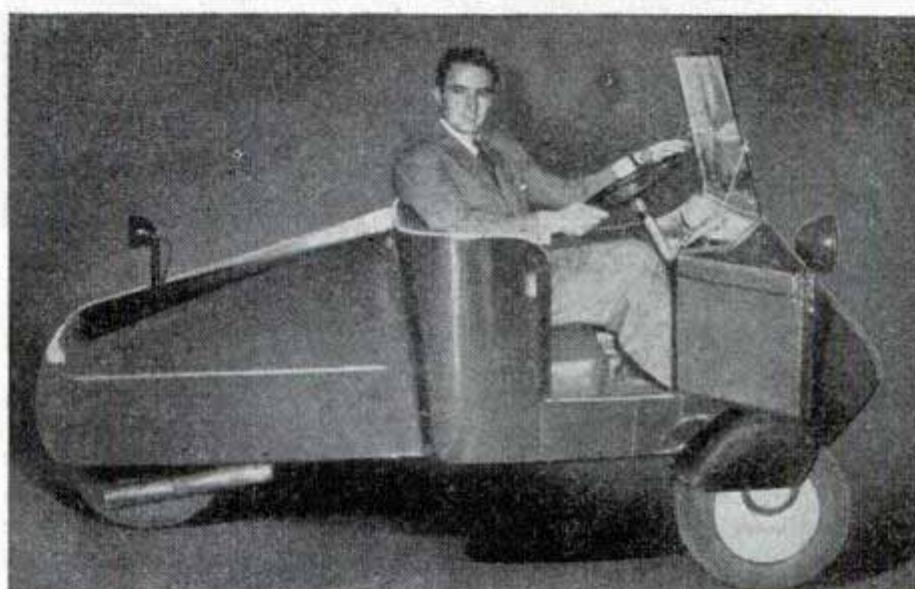
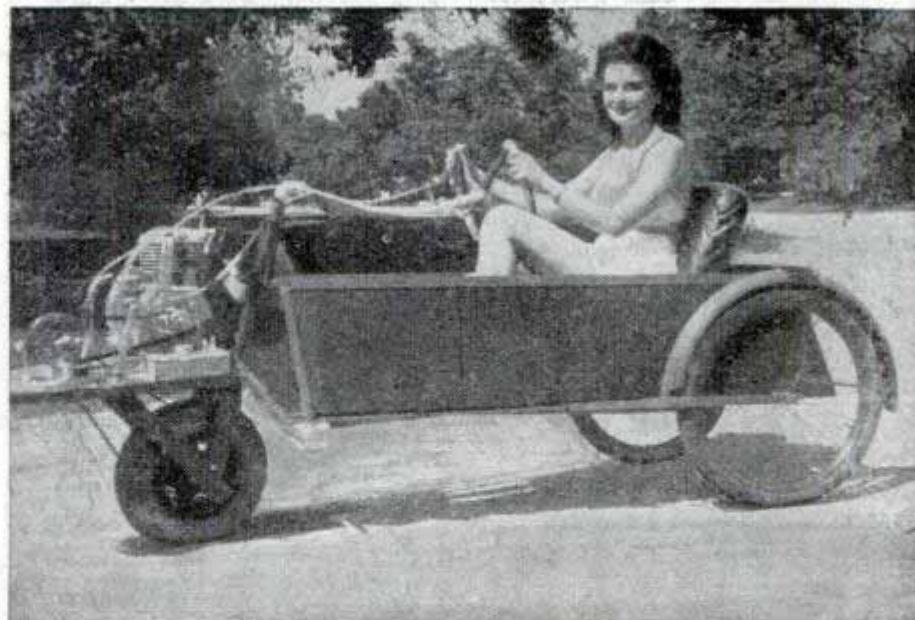


Although the military jeep has seen "Paree" and served all the way from Tokyo to Berlin, this Army choreboy has settled down on the farm to perform scores of duties. It serves as tractor, light truck, passenger car and, with a special power takeoff, as an independent power unit. On an Illinois farm, it was used to tow a one-row corn binder with the motor furnishing power to run the binder.

Home Mechanics Build 3-Wheeled "Junkmobiles"

Parts from a washing machine, wheelbarrow, bicycle and windmill were used by V. G. Clements of Elmwood, Neb., to build the "tricycle" shown at right, top. The half-horsepower engine was from a washing machine; front wheel from a wheelbarrow; back wheels from a bicycle, and control rods from a wrecked windmill. The "junk-cycle" gets from 60 to 70 miles on a gallon of gasoline and scoots up hills at 10 miles an hour.

The homemade automobile at the right (in which the builder, Robert E. Taylor of Bridgeport, Conn., is seated), is a three-wheeled motor scooter. Powered by a four-horsepower engine, the car has a top speed of 30 miles per hour and carries two persons. Its electric starter is from a standard automobile and the steering wheel once served a motor boat.



Lightweight Radio Mine Detector Unearths Hidden Explosives

Ultra-high-frequency radio wave transmitters developed near the close of the war by the Radio Corporation of America made it possible for our soldiers and Marines to detect both metallic and nonmetallic mines. The transmitters were installed in 20-pound portable detectors which were operated with a sweeping motion two or three inches above the ground to reveal—by a buzzing noise and dial alarm—the presence of mines.

Submersible Storage Battery

Total submersion in several feet of salt water has no effect on operation of a storage battery developed for use on motor vehicles. The system is based on the principle of the diving bell which allows sea water to enter a compression dome or a bell housing a breather standpipe. Relative volume and height of the standpipe are adjusted to the size of the battery and the maximum depth of submersion.

FIDO FIGHTS FOG

Burning holes in California fog to bring the planes down safely was an idea borrowed from Britain—lend-lease in reverse! We're also shaking the fog down with horns and fans and fountains

By Thomas E. Stimson, Jr.

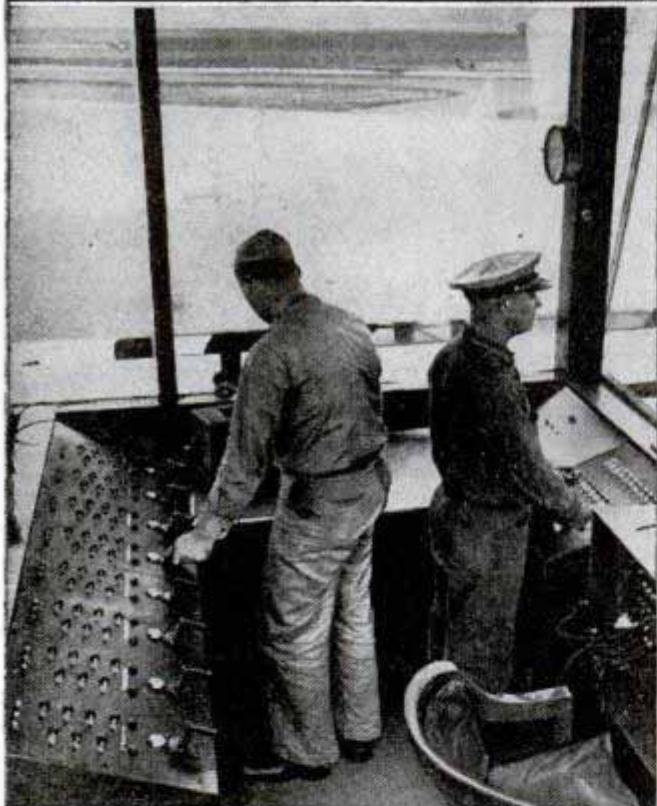
ZERO-ZERO weather, the pea-soup kind that cancels all air operations, has yielded to a mechanical hot-foot.

On one recent morning the whole northern coast of California lay under a solid fog blanket 1500 feet thick. At Arcata the flight dispatcher at the Navy's Landing Aids Experiment Station couldn't see even a portion of his runway. Ground operations were at a standstill.

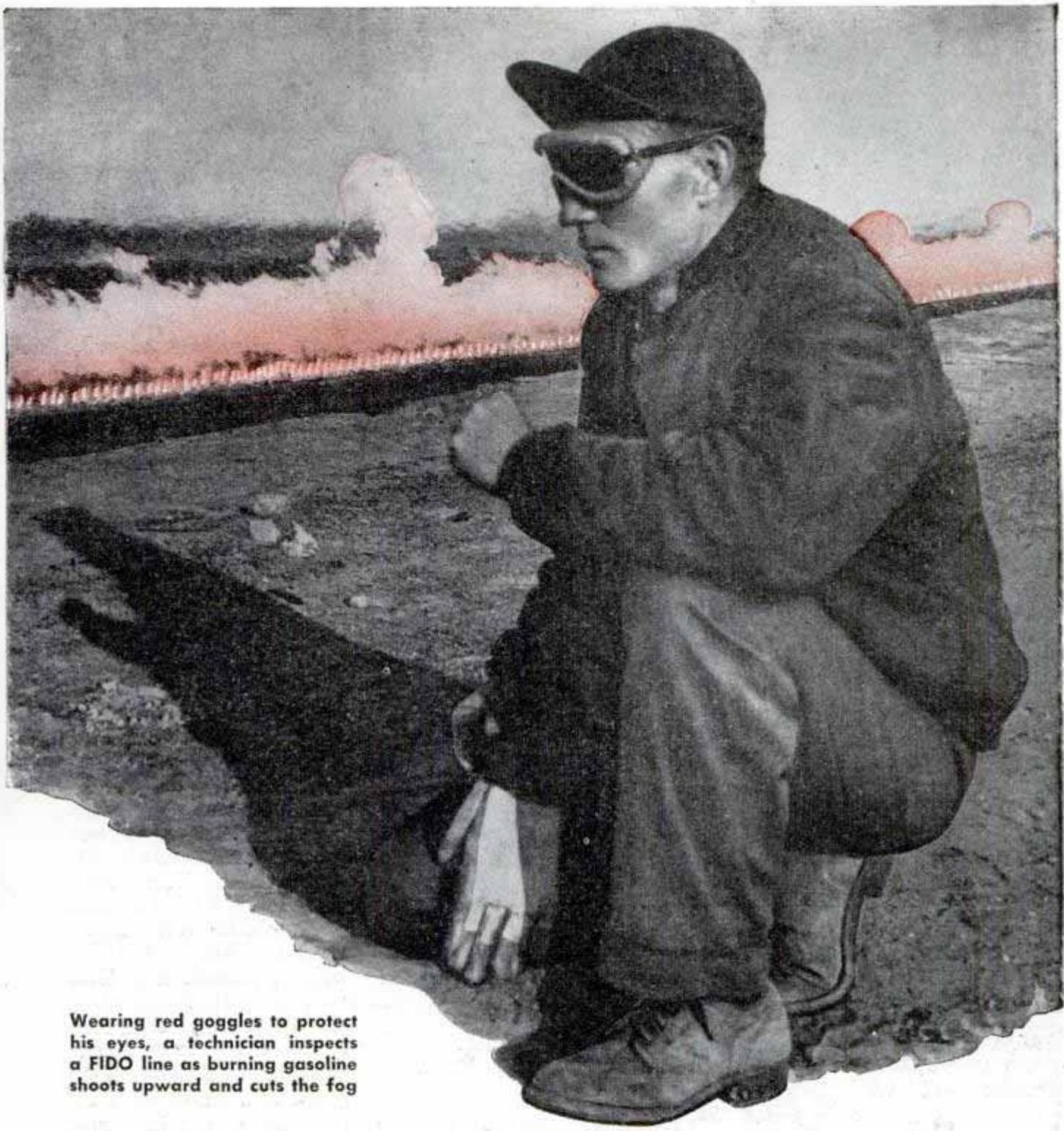
Then, in his earphones, the dispatcher caught a message from an inbound plane. "Turn on your FIDO, I'm coming in!"

Promptly he twisted several switches and punched a few buttons on a control panel, then watched while two long lines of flame began to outline the landing runway. The dense fog slowly thinned and lifted. Within 10 minutes the sun broke through and there was blue sky overhead. The oncoming plane burst out of the fogbank to the east, settled in, and landed normally.

Ten minutes later, with the plane in its hangar and the FIDO installation turned off, the field again was shrouded in fog.



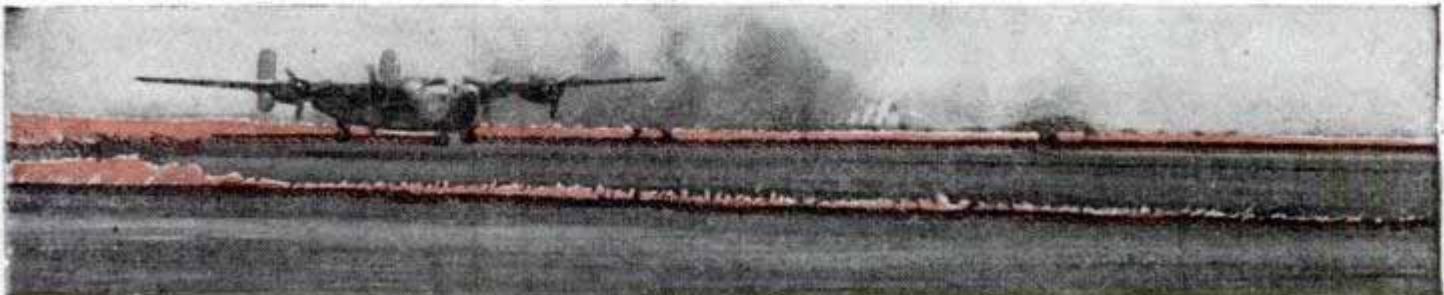
Dispatchers watch fog disappear after FIDO burner is turned on to clear the way for the plane below to make a safe landing on the now visible landing strip

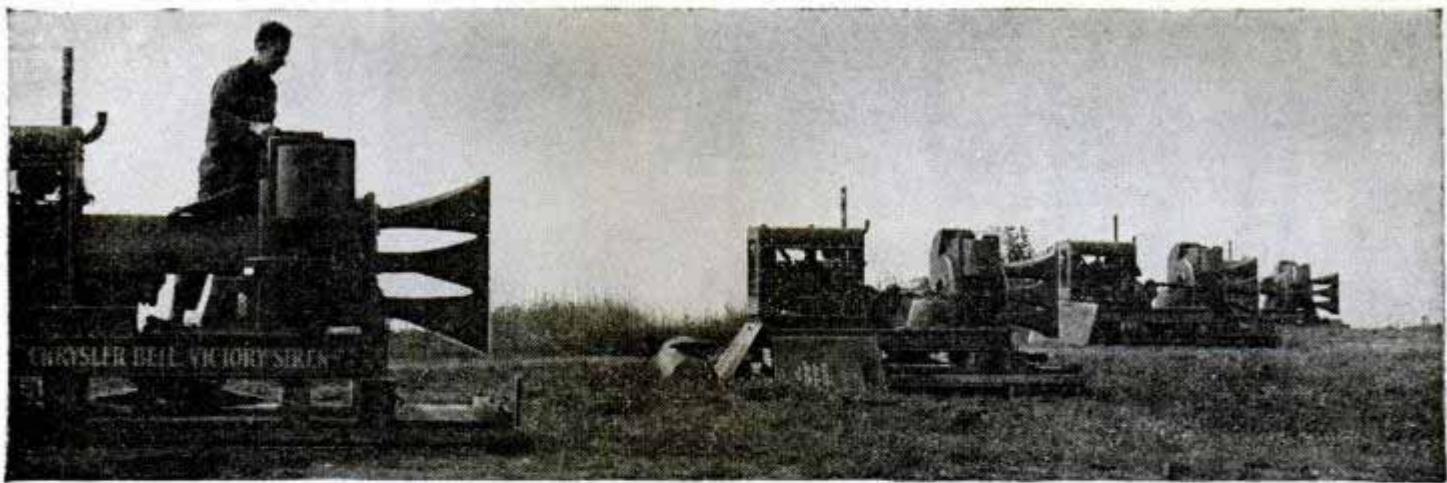


Wearing red goggles to protect his eyes, a technician inspects a FIDO line as burning gasoline shoots upward and cuts the fog

FIDO, which can be interpreted as "Fog, Intensive, Disposal of" or "Fog Investigation Dispersal Operation" depending on whether you live in America or England, was born in Great Britain out of the desperate need for some emergency way to land heavy bombers after sudden fogs had settled over their landing fields. Evapo-

rating the fog by the heat from vast amounts of burning gasoline was the one idea that worked, although the first experimental installation consumed 200,000 gallons of aviation gasoline per hour at a fuel cost of about \$4000 per airplane landed. But that emergency method saved 187 bombers and their crews on one night alone

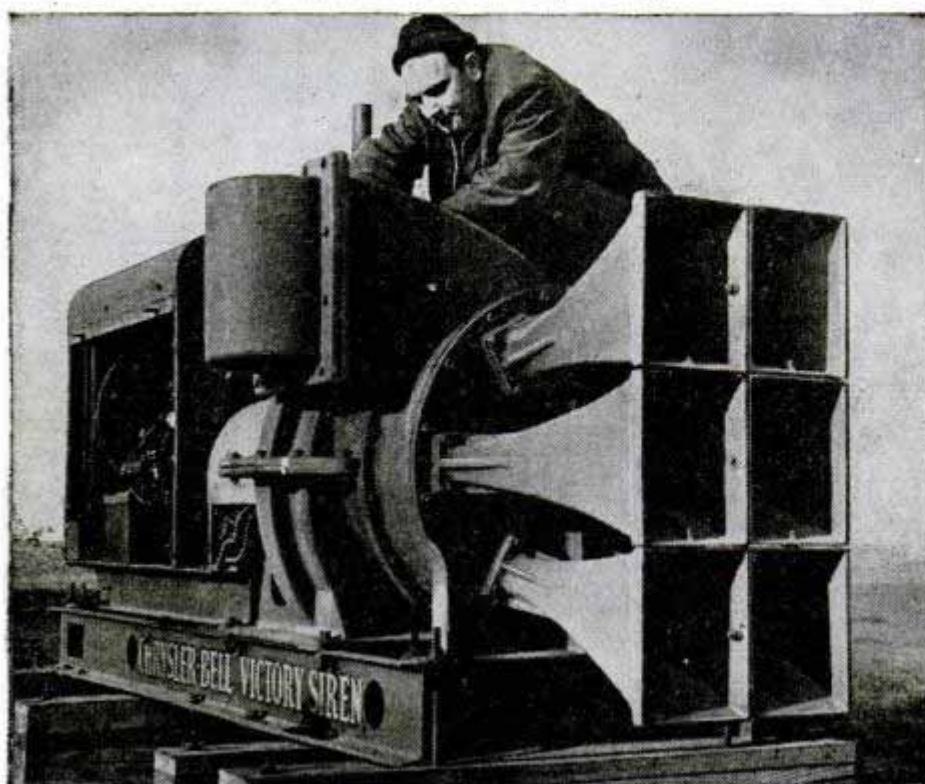




The roar of these horns—called sonic generators—bumps fog particles together, creates rain and lifts fog



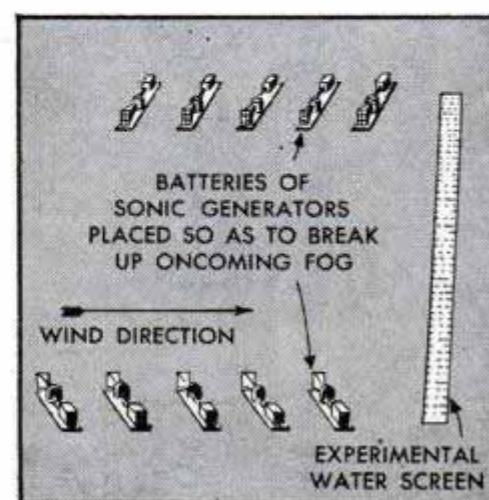
Pipe lines to carry gasoline are installed in trenches like this in FIDO installations. Below, close-up of a six-siren sonic generator which creates a noise heard many miles from Arcata, Calif., scene of the fog tests

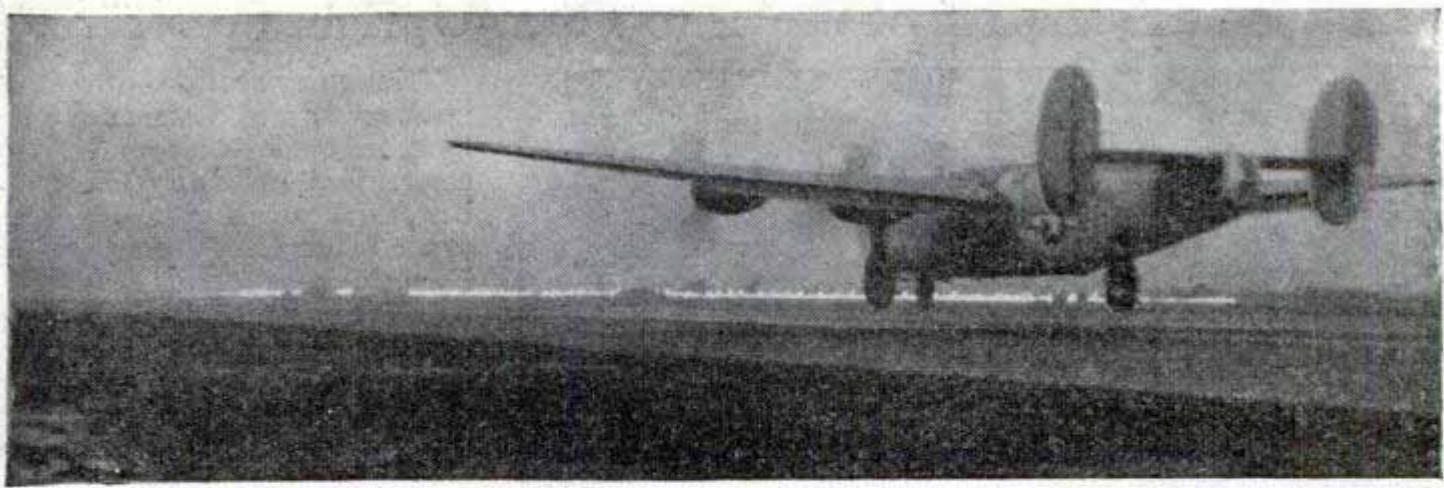


after an unpredicted fog had blanked out the whole island.

Improvements in the efficiency of the apparatus made it feasible to install FIDO at 15 fields, allowing mass takeoffs and landings in weather so bad that German meteorologists couldn't understand how Allied bombers dared leave their bases. Portable FIDOs later were installed in France during the push into Germany.

Using British-designed burners with some modifications, the U. S. Navy installed a FIDO system at Amchitka in the Aleutians in 1944, and FIDO helped launch and land antisubmarine patrols through fogs and fog-drizzles that were sometimes a mile thick. Two parallel burner lines on one side of the field and one burner line on the other were installed at





While gasoline-burning FIDO lines lift the fog and increase visibility, a plane comes in for a safe landing

Amchitka to insure visibility in spite of winds up to 15 knots. In moderate weather one burner line sometimes was enough; in unusually thick weather with a rapidly drifting fog all three lines were burned.

Pilots in the sunlight overhead reported that they were able to locate the man-made hole in the fog as far as 15 miles away. The orange tint of the flames was reflected from the edges of the hole both night and day.

Coming down to land, the pilots made standard instrument approaches through the fog and broke out into the clear over the marker burners at about 150 feet altitude. The hot air near the runway was turbulent and created a floating effect but the pilots made normal landings easily.

It's possible, of course, for a highly trained pilot to land blind without the help of FIDO. Instrument approaches plus radio "talk down," localizer and glide path radio beams, and radar landing systems are three methods by which pilots can land in spite of bad weather. Any such landing assist-

A \$200 machine that sprays out a chemical may become a potent weapon to combat fog. Developed by Clellan Ross Pleasants, of San Francisco, the "Nofog" device is said to lift fog by changing the humidity of the surrounding area. The atmosphere absorbs fog and sheds the excess as rain. Army and Weather Bureau officials recently watched a demonstration of "Nofog" machines clearing fog from an area in the San Francisco Golden Gate channel

ance will line a pilot up with the field and bring him in over the approaches at about 150 feet in the air. From then on it's up to him. None of these systems can substitute for the accuracy and judgment of human eyes in the last few critical seconds of a landing operation. In the words of one officer, "A completely blind landing is considered to be more of a stunt than a normal operating procedure with acceptable risk. Visual check of the runway is necessary for a safe landing at the present time."

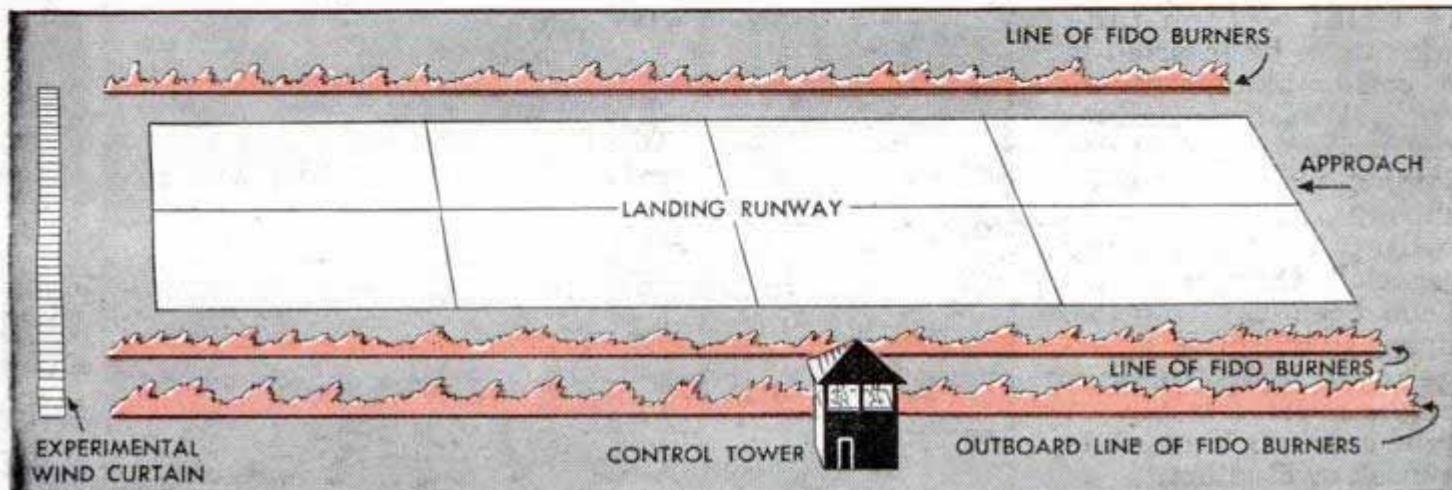
With this in mind the Navy selected Arcata, its foggiest continental air station, as the site for an experimental field at which all kinds of efforts

to control the weather or to operate in spite of it could be tested. Radio and radar systems, improved types of FIDO, wind curtains, water screens, desiccants, and other ideas will be tried and evaluated there.

Preliminary studies on some of these subjects were made during the war by the Universities of Illinois, Iowa and California,

(Continued to page 158)

Drawing of airfield equipped with FIDO fog fighting equipment and sonic generators (shown on opposite page)



Book Rest Folds Out of Cover to Form Upright Support



Triangular sections of a book cover fold down and lock in back to form a convenient holder. The built-in book rest, invented by H. P. Botts, New York artist, supports a book in an upright position for reading or reference. It is handy for students or office workers and can be used with notebooks and looseleaf ledgers. Bed-ridden convalescents will find the holder useful since it holds a book so it can be read easily from a reclining position.

Army's "Mine Scenting" Jeep Locates Buried Explosives

Like a hound sniffing the trail of game, a "mine scenting" jeep has been developed by Army engineers to locate metallic explosives buried beneath the ground. In action, the mine detection device is lowered in front of the jeep on a seven-foot boom as the vehicle creeps along at four miles an hour. The instant a mine is encountered, the jeep automatically goes out of gear, puts on its brakes and comes to a dead stop. When not in use the boom is raised to an upright position and the jeep proceeds in a normal manner.



Oxygen Tank Gives Parachutist Air

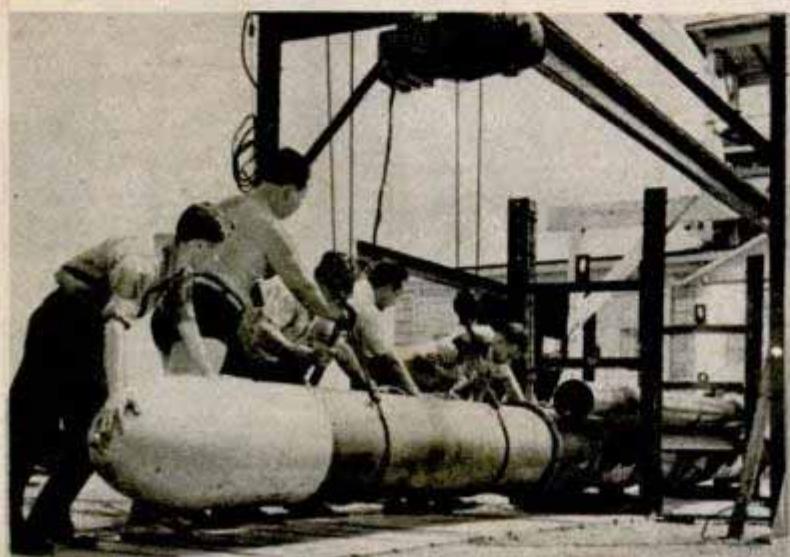
Among recent patents is a flat oxygen tank which can be inserted in a cushionlike parachute pack. This tank reduces the peril of a high altitude jump in the thin air of the substratosphere by providing a respiratory "snack." Oxygen bottles have been used for this purpose, but in an emergency a built-in tank might avert disaster. A tube connects the tank to a mask or breather.



FLIGHT LINE TALK

When a man makes a throat cutting gesture or holds his nose on the flight line at the Glenn L. Martin plant near Baltimore, nobody bats an eye. It saves shouting. Right, signal to set up fuel pressure is acknowledged by the pilot



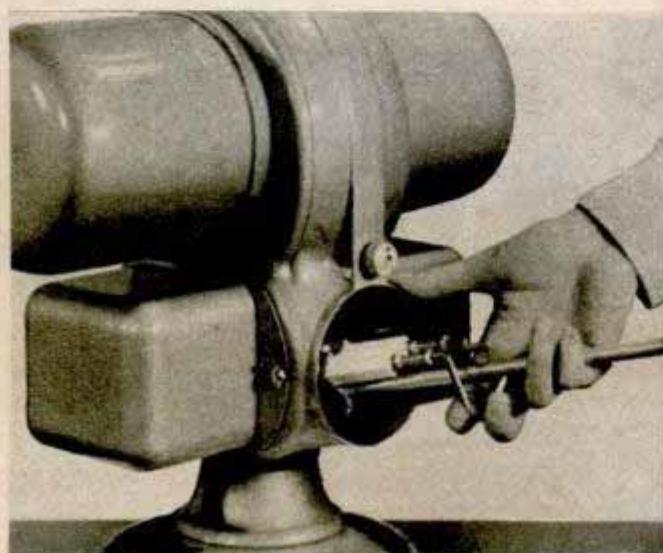


Electric Torpedo Fired by Sub Leaves No Telltale Wake

Electrically propelled torpedoes fired from U. S. submarines and leaving no telltale trail of bubbles sank 372 Japanese vessels for a total of 1,858,200 tons of shipping. The targets ranged from a 42,500-ton battleship to cargo-carrying merchant ships and naval auxiliaries of 500 tons. Amidst great secrecy, the Westinghouse Electric Corporation designed and built the electrically driven torpedoes. A major design problem was the development of a light-

weight power plant to drive the torpedo. The answer was a 275-pound motor combined with a high capacity battery developed by the Electric Storage Battery Company. Another problem was to

find a substitute for solder to bind coils to the commutator since solder would melt under the intense heat of the enclosed high speed motor. A new system of brazing the coils, plus baking in synthetic resin under infrared lamps for 18 hours, provided the solution. Gases generated within the torpedo were disposed of by a tiny electric wire in the battery compartment, thus preventing any visible wake in the water from escaping gas. Nazi submarines demonstrated early in the war that electric torpedoes were more potent than the old type torpedoes driven by compressed air which left a trail of bubbles.

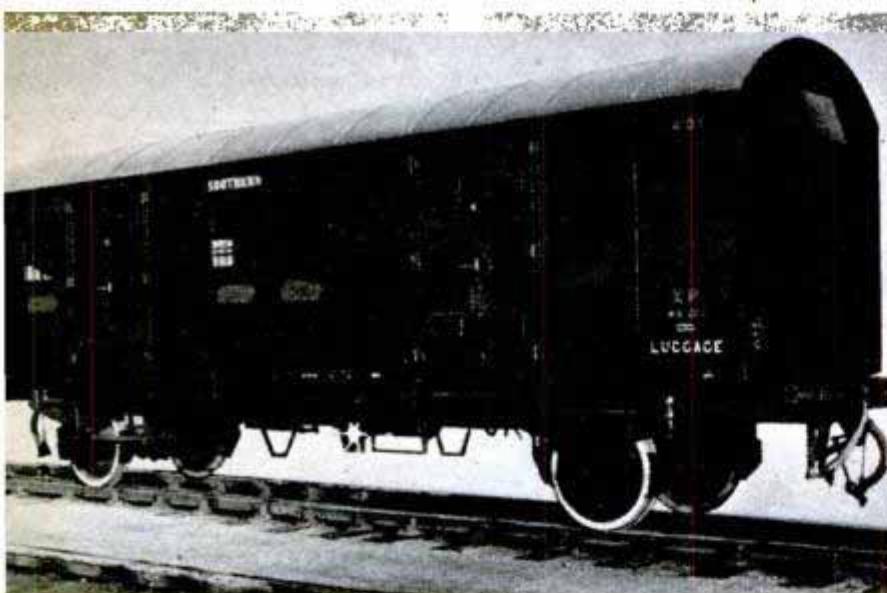


Compact 89-Pound Oil Burner Has No Exposed Parts

Weighing only 89 pounds, a streamlined oil burner with no exposed working parts is now being manufactured. The unit, said to fit into any heating plant, is so designed that its vital parts can be removed easily for adjustment. The complete electrode assembly and tube to nozzle can be removed through the back of the burner. The air control is mounted on the outside and can be adjusted to provide the most economic atomization of the oil fuel.



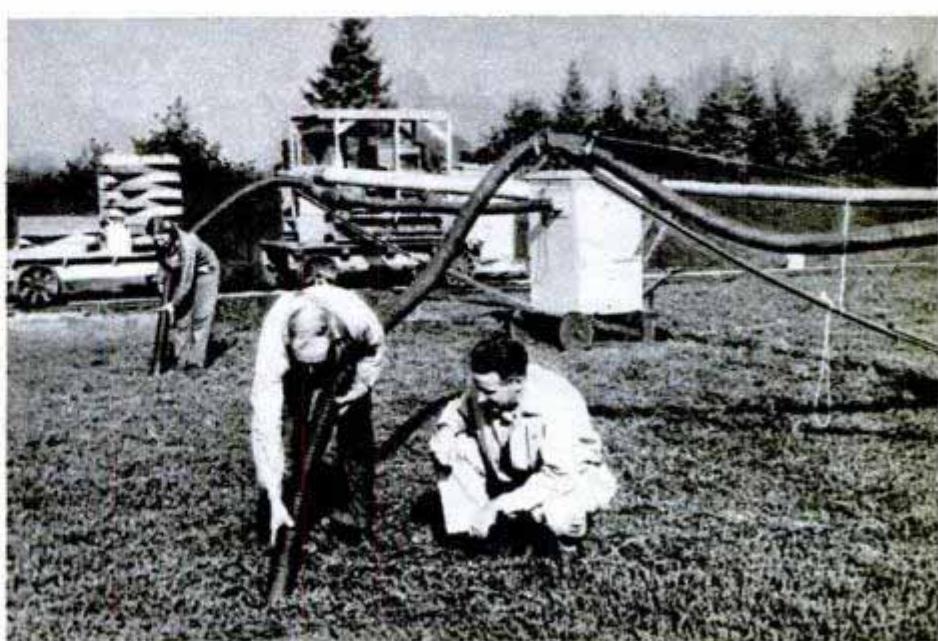
INSECT-KILLING CHEMICAL DUST is blown on crops and fruit trees with 185-mile-an-hour cyclonic force by a "cyclone duster." Equipped with a 24-nozzle boom that covers eight rows of crops, the bug killer is mounted on the front of a tractor and operated by the driver. With a capacity of 150 to 200 pounds of chemical dust, the machine has a four-cylinder motor which revolves a steel bladed fan at 3600 revolutions per minute to create the man-made wind that distributes the powdered chemical evenly. One duster can cover 100 acres in a day. Various combinations of nozzles and hoses are available for different crops and for fruit trees



PLASTIC PANELS give strength and light weight to bodies of passenger-baggage cars being built by the Southern Railway of England. Novel body-cushioning devices also are employed to safeguard the cargo. Somewhat smaller than conventional cars, the plastic cars are regularly employed in high-speed service. The panel plastic is reinforced with woven high-tensile steel wire and cotton to reduce brittleness. It weighs only 11½ ounces per square foot, a fourth of the weight of steel or wooden panels, and is fastened to the steel framing by screws fitted into furred strips in channel sections. The body is independent of the main frame, with cushioning springs of steel coils and rubber, permitting longitudinal movement up to 11 inches

A MECHANICAL CRANBERRY PICKER that operates like a giant vacuum cleaner is credited by its inventor with duplicating the speed of 50 persons picking by hand. A. V. Anderson of Grayland, Wash., who developed the device in conjunction with U. S. Rubber Company engineers, says the big rubber hose not only sucks up cranberries rapidly but also cleans them by drawing off weeds, dust and leaves. The machine does not disturb the buds, Anderson explains, and thus will increase the cranberry yield

Every day new products for homes and workshops, farms and factories, are appearing on the nation's markets, and every month you'll find them described in Popular Mechanics. For additional information, write to the manufacturers listed on page 8A in our Where-to-Buy-It Index



FLYING FREIGHT



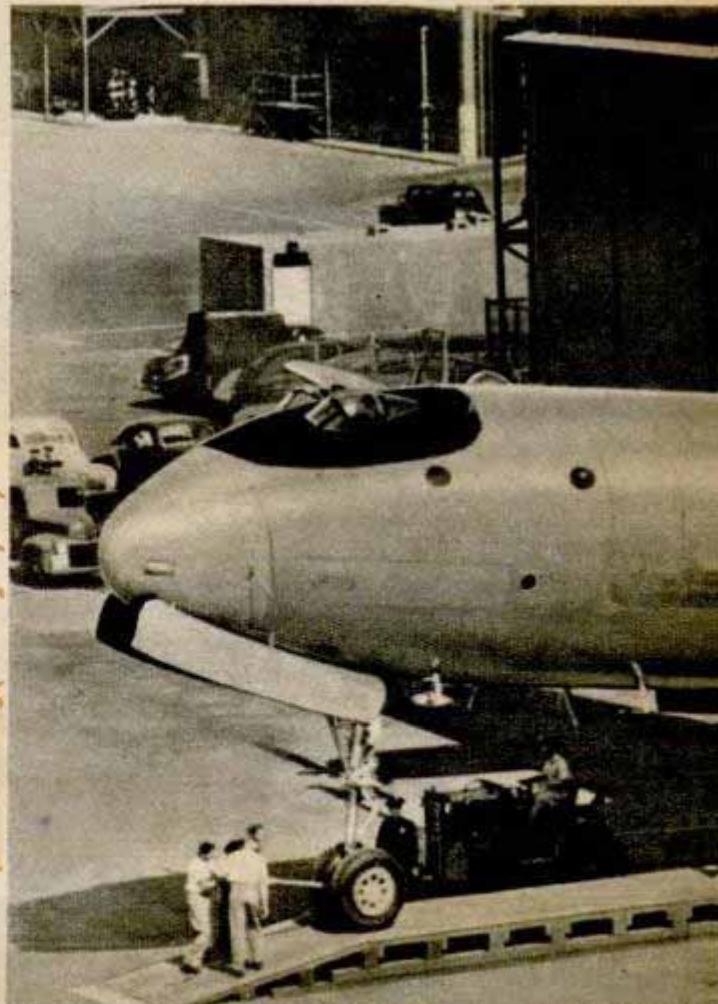
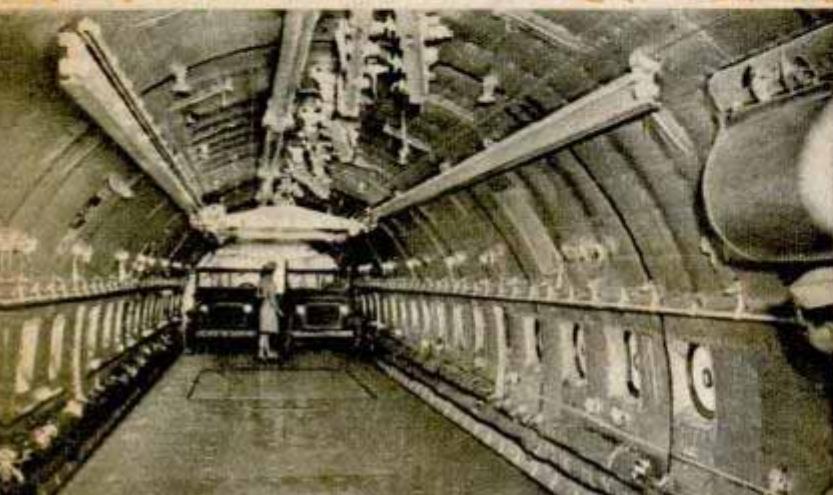
Douglas Globemaster raises jeep into cargo compartment with own elevator which can lift eight tons

By John L. Kent

ONE THURSDAY several months ago, Cleveland housewives served strawberries, tomatoes and lettuce which 48 hours before were still growing in California sunshine—2400 miles away. A huge four-engine airfreighter brought the 18,500-pound load of fruits and vegetables from Salinas, Calif. It was the largest shipment of its kind ever flown by a commercial air cargo plane in the history of the nation's air transportation.

The experimental plane, built and owned by Consolidated-Vultee Aircraft Corporation, is known as Convair Model 39 and is operated by American Airlines. Arrival of the airfreighter marked the inaugural flight in a special three-month research program

Two jeeps parked side by side are drop-in-the-bucket cargo for C-74 Globemaster which carries 30 tons



in large-scale transcontinental transport of perishables to determine whether such flights are practical.

The experimental nature of the operation has made it possible for American Airlines to charge the shipper approximately 15 cents per ton-mile as compared with the lowest commercial rate now offered of 26 cents. At first glance, the high weight and low value of fruits and vegetables would rule out any consideration of transporting them by air—the most expensive transportation of all. The transportation charges, you would think, would so increase the cost that the consumer might refuse to pay the high prices. Results of the experiment should show whether the public is willing to pay the extra costs of getting vine and tree-ripened fruit and crisp lettuce. Of more importance, however, is the fact that the



"Bug eyes" of C-74 Globemaster provide pilots with unobstructed vision

future of all domestic air transport hinges to a greater extent upon a large and continuous volume of perishable products than upon any other source of pay load. All experts agree on this. Why?

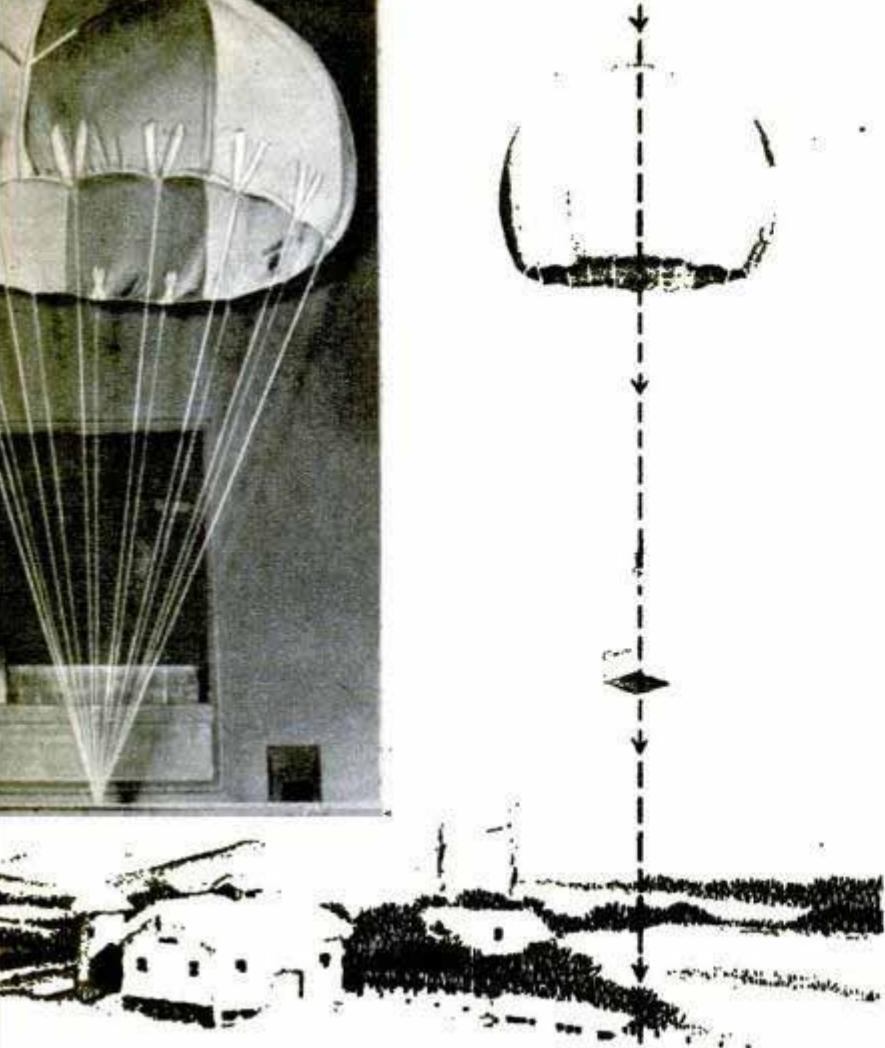
The answer is simply that fresh fruits and vegetables hold a key to the profitable operation of transport planes on their west-to-east and south-to-north flights. High-

Overall view shows Globemaster's wing is almost amidships; black paint around "bug eyes" prevents glare

DIMENSIONS
SPAN—173 FEET 3 INCHES
LENGTH—124 FEET 1½ INCHES
HEIGHT—43 FEET 9 INCHES
PROPELLER DIAMETER—19 FEET

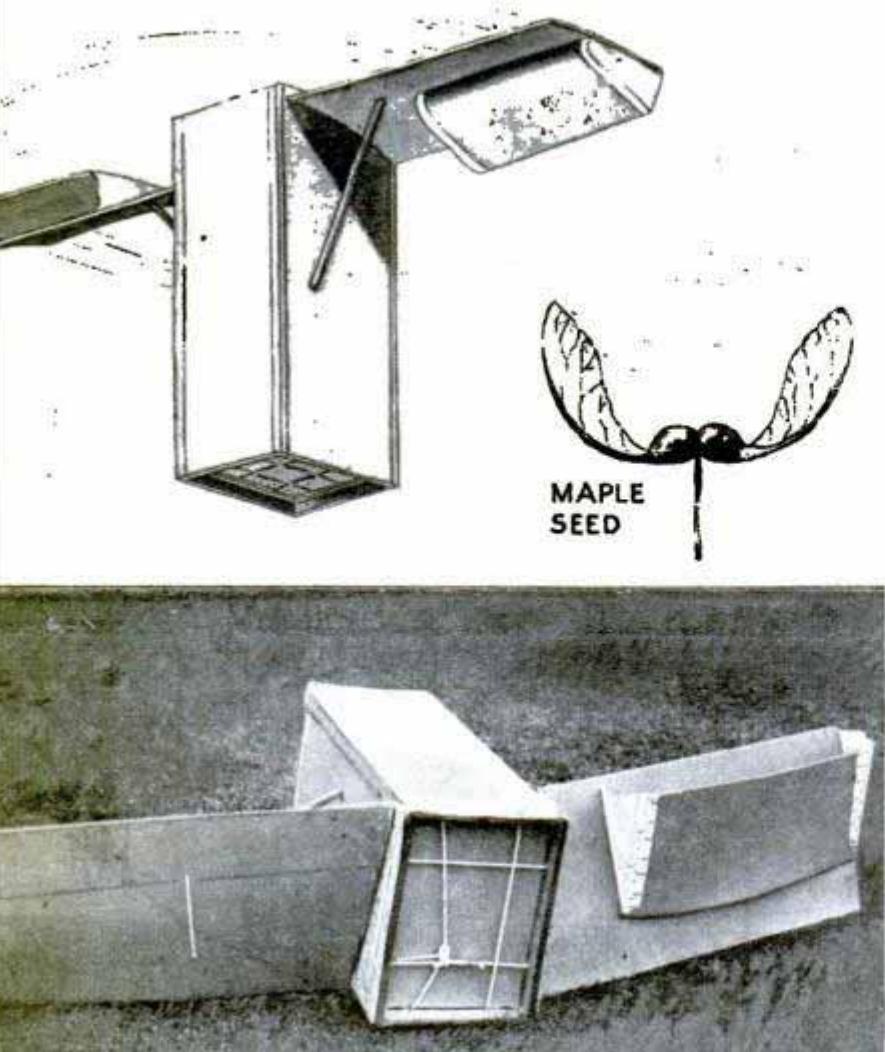
265402





General Textile Mills, Inc., photo

"Baseball" type parachute is nonoscillating and slow inflation minimizes opening shock. Below, rotary wing cargo chute



value-low-weight manufactured goods can be found in plenty in our northern and eastern cities to make profitable east-to-west and north-to-south traffic at reasonable air rates. It is on the flights north and east that the airlines find it hard to fill planes. In order to be commercially successful, planes must be loaded almost to capacity on both flights. Thus, on its return flight, the air-freighter carried 18,500 pounds of gas ranges from Chicago to Burbank, Calif.

During the past four years transport prophets have been gazing into the postwar future and emerging with predictions about the great future of transport aviation. Now the postwar is here—and the prophets suddenly are silent. In their place the great airlines of the nation have started on the practical possibilities of air cargo transport—to find out by experiment just how much air cargo there is.

Many self-appointed prophets saw a great cargo fleet resulting from Army cargo and bomber planes. But the commercial operators are not convinced of the ultimate economy of converting Army C-47 or C-54 transport planes to domestic freight hauling any more than most people are convinced that discarded Army jeeps ever can substitute for the family sedan.

"It's all a question of the equipment's suitability for the job it is intended to perform in civilian life," said Claude N. Palmer of the United Fresh Fruit & Vegetable Association, speaking before the Air Transport Users Conference in Washington. "The main factor is: Can it do the job as economically, or more economically, than a plane of more modern design? The military demanded the latest in equipment. By the same reasoning, industrial competition will demand the latest and best of equipment to counteract wartime handicaps and restrictions."

Planes for air cargo, therefore, fall into two classes: Surplus war cargo carriers and new cargo carriers. Since all effort by aviation companies has been on military cargo planes, the peacetime cargo carriers still are in the de-



Converted British Halifax bomber has detachable freight compartment in place of bomb bay. Below, first commercial aerial shipment of heavy goods arrives in Los Angeles from Chicago

sign stages. However, there are several different types of military planes available for commercial cargo service.

Among these is the Douglas DC-3 type, the military versions being known as C-47 and C-53. American Airlines already has converted a standard DC-3 transport into an airfreighter. The interior of the airplane has been completely redesigned and all windows and other features of the passenger airliner have been removed. The converted ship features a thermostat temperature control for transportation of perishables and seven cargo bins each capable of holding up to 750 pounds. The new plane is the first of 20 such airfreighters which the line intends to put into domestic service.

Another possible cargo conversion is the C-54 or DC-4 type. It has proved its worth in military service. The Douglas C-74 Globemaster is the military cargo version of the DC-7, big brother of the C-54. This four-engine aerial giant has a wing span of 173 feet and three inches—32 feet wider than the B-29—





Boeing C-97 has two decks and usable cargo space almost equal to that of two average railway boxcars

and carries a pay load of 30 tons. Built for transoceanic service, the Globemaster will fly nonstop more than 7500 miles. It carries its own crane, hoists and cargo elevator for loading and unloading.

Other postwar aerial freight possibilities are the Lockheed Lodestar types, among which are the C-37, C-56 and C-60. To this group may be added the twin-engine Curtiss Wright Commando, or C-46.

Among the four-engine Army transports there are the C-87 Consolidated Liberator-Express and the Lockheed Constellation, or C-69.

One of the newest entrants is a transport counterpart of the Boeing B-29 Superfortress—the C-97. A commercial version

There's room for standard bowling alley and 15 feet to spare in main compartment of C-97, transport version of Superfortress



of the plane, to be known as the Boeing Stratocruiser and capable of carrying up to 100 persons, has been announced. The C-97 has wings, tail surfaces and landing gear identical to those of the B-29, but the volume—10,000 cubic feet—is more than twice that of the B-29. It has usable cargo space almost equal to that of two average railway boxcars. A unique feature of the C-97 is a pair of great loading doors which open under the rear of the fuselage, with a drive-up ramp which is let down from within. The ramp is self-contained in the plane and is retracted by an electrically powered cargo hoist so that no special equipment is necessary.

One of the newcomers to the Army cargo plane ranks is the Fairchild C-82, nicknamed the Packet. As a cargo carrier, the "flying boxcar" can carry a maximum pay load of nine tons on flights up to 500 miles, and six and one-half tons for 1500 miles. The Packet's immense cargo compartment, with 93 percent as much cubic capacity as a railroad boxcar, is long and square-sided. It loads from the rear end, eliminating the usual cumbersome methods used in loading heavy cargo.

Huge double doors in the rear of the fuselage open like a clamshell to the full width of the cargo compartment. There is plenty of room under the high twin-boom tail for a large truck to back up and unload cargo directly into the

plane. Transfer of cargo is facilitated by the fact that the Packet's floor is level at truckbed height. There also is a side loading door at the forward end of the cargo compartment.

These quick, convenient loading features, combined with a comparatively low direct operating cost per ton-mile (estimated at less than seven cents for trips under 500 miles) are expected to give the Packet a competitive advantage as a commercial air-freighter on short runs.

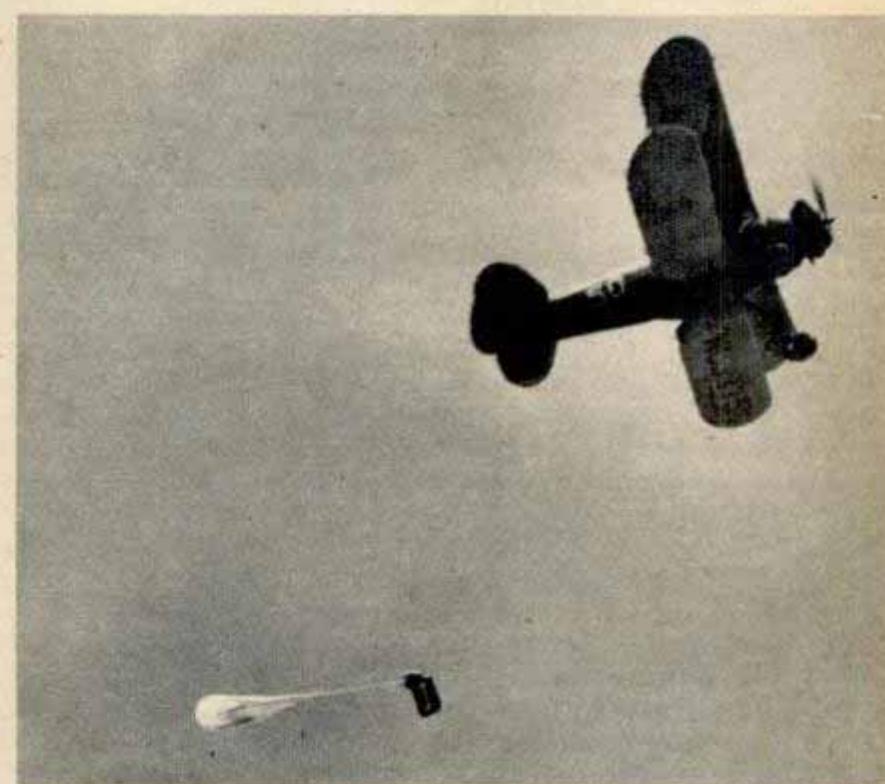
Since the prime advantage of shipping cargo by air is speed, the scope of air cargo service is limited when the final destination is not served by air lines. At the present time there are only about 350 points in the United States served by commercial air liners. However, to bring the advantages of air transport to other communities, air lines are experimenting with parachute dropping of cargo. The idea is not new; our Army has been using it for several years, and emergency air delivery at isolated spots has been made by commercial carriers on many occasions by parachute. Many new types of parachutes and dropping containers are being tried out. One of these is a combination parachute and container, which when dropped from a plane sprouts wings or rotors. These wings limit the rate of fall and drift. The container can drop 50 pounds safely.

Another type of parachute immune to oscillation in descent, which is common to ordinary parachutes, has been tried by the Army. It has been nicknamed the "baseball parachute" because it is constructed in hemispherical shape through the sewing together of material cut in the form of a figure eight in the manner of a baseball cover. Dishes, phonograph records and glassware are among the fragile items successfully parachuted from cargo planes.

American air line companies also expect gains in overseas air cargo as a result of several planes nearing completion. Chief among these is the Mars type flying boat, several of which are on order with the Glenn L. Martin Company for the Navy Transport Service. It is patterned after a converted patrol bomber, the Mars, which carried



Manhattan Storage and Warehouse Co. photos
Veneer box for cargo chute test contains radio and 12 tubes



Swinging from special parachute is fiberboard carton containing phonograph records. Below, records landed without scratch

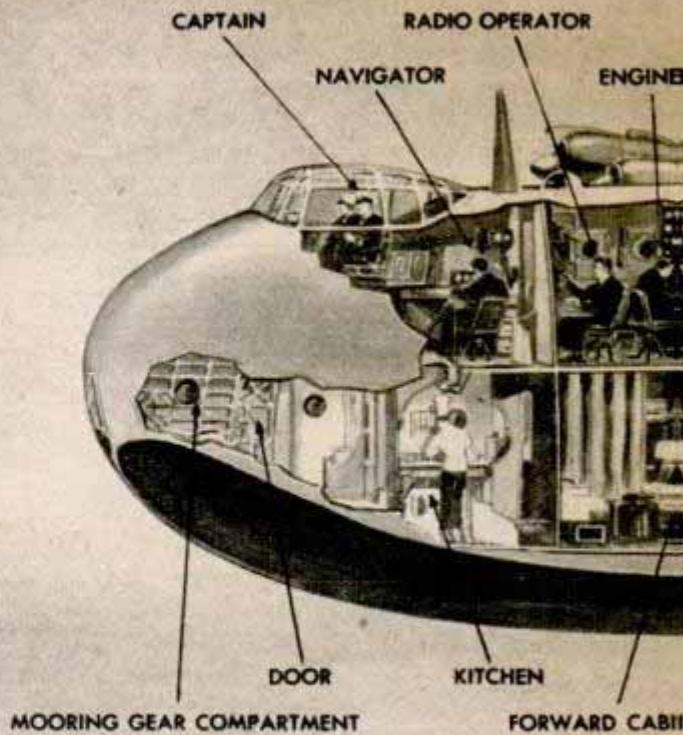


an average pay load of 22,000 pounds for a distance of 2400 miles between Alameda, Calif., and Pearl Harbor. The new type Mars weighs 72 tons and will carry the same load for an increased distance of 3550 miles. The postwar model, with engines throttled to two thirds power, will carry as much as 50,000 pounds of pay load for 2000 miles at a speed in excess of 200 miles an hour. On this commercial model the four present engines, totaling 9000 horsepower, will be replaced with four Pratt & Whitney Wasp Majors, raising the rated horsepower to 12,000 plus.

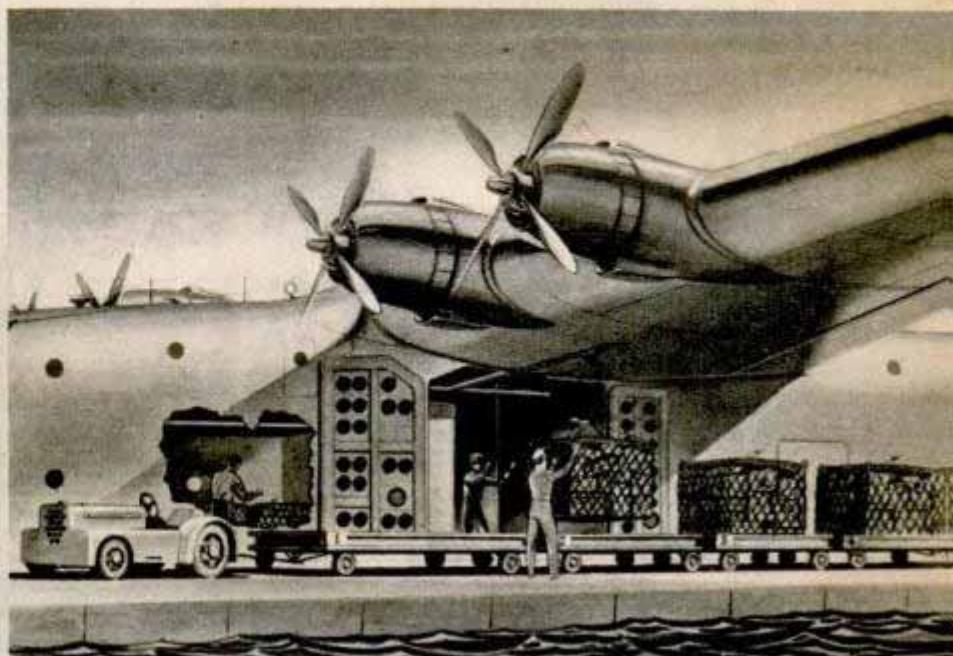
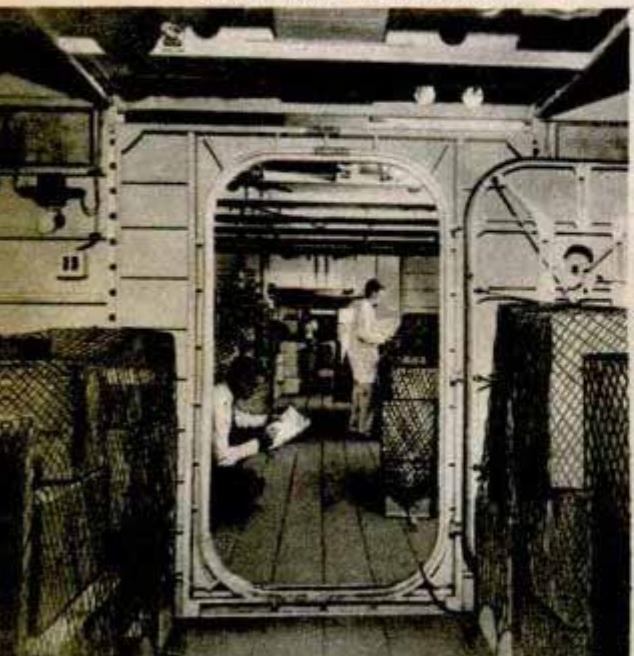
Another commercial overseas possibility is the C-99, world's largest land-based troop carrier plane nearing completion at San Diego by Consolidated-Vultee Aircraft Corporation. It was intended as a troop transport and is the military counterpart of the recently announced Model 37, a 204-passenger luxury liner ordered by Pan American World Airways for transoceanic service.

Because of its capacity it is readily convertible to cargo operation and will carry a pay load of 100,000 pounds over a distance of 1500 miles. Loaded with 19,000 gallons of fuel, it will have a range with a reduced pay load of approximately 8000 miles. The "99" has a wing span of 230 feet and is powered by six pusher-type engines. The 183-foot aluminum fuselage is completely double-decked with two large ramps in the bottom section for loading. Equipment includes monorails and electrical hoists.

Some experts feel that overseas air lines have a better chance at cargo operation than domestic operators. The coming battle is going to be played at the home field. Can air cargo seriously compete with the railroads, the trucking industry and other



Mars type flying boat carries 22,000 pounds of freight; below, interior view and loading scene at dock
Glenn L. Martin Co. drawings

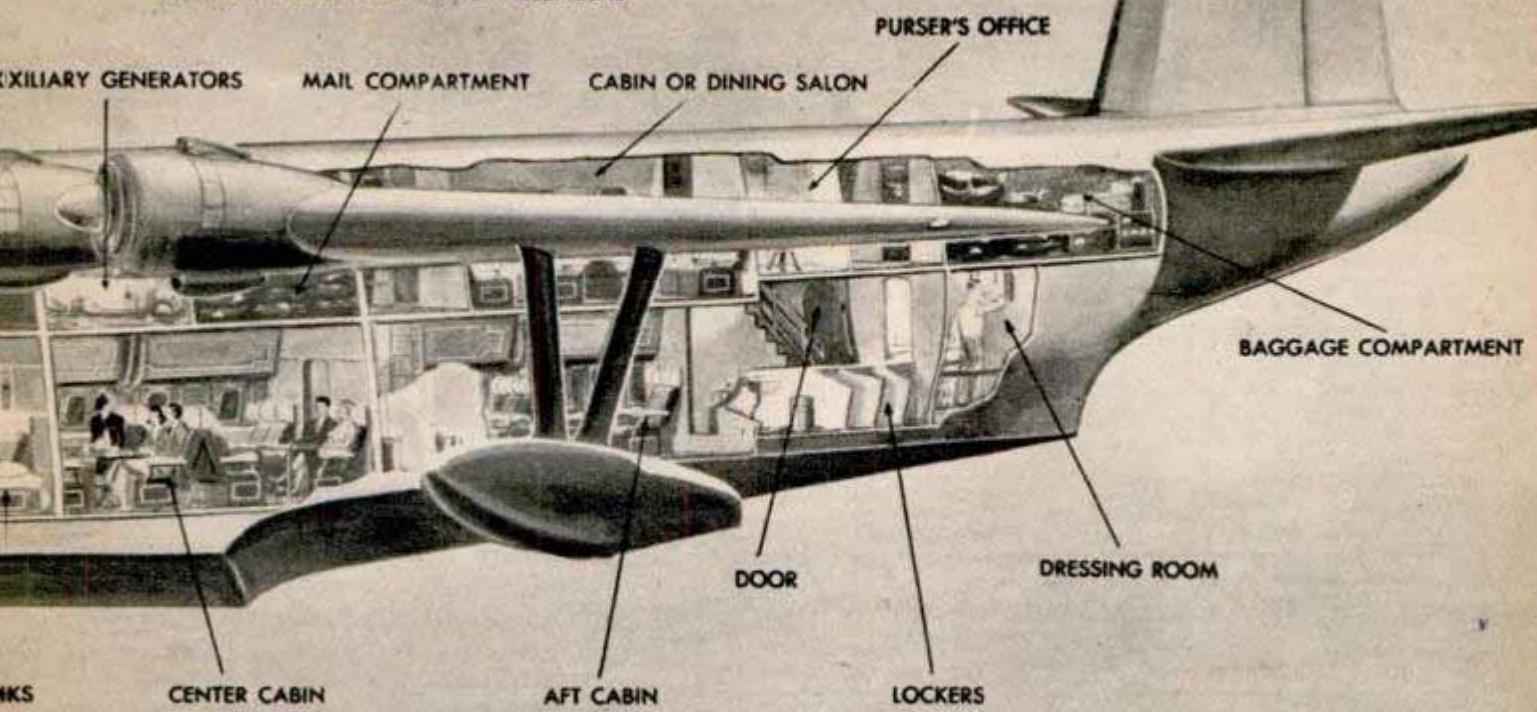


forms of surface transportation? Can air cargo ever get its rates low enough to attract the large volume traffic it must have to become one of our major systems for the transportation of goods? Here's one side of the picture—the dark side:

Cargo loading costs run between \$10 and \$15 per ton at airports, but only 50 to 75 cents per ton at rail and truck terminals. The rail freight rate per pound from New York to Chicago is 2 cents, by rail express under 5 cents, but by air freight 15 cents.

But here's the other side: Do you remember the receding tracks and roadbed as you

ENGINES—FOUR BRISTOL 18-CYLINDER
OVER 2500 B.H.P. EACH
DIMENSIONS—SPAN—150 FEET
LENGTH OVER-ALL—107 FEET
WEIGHT—130,000 POUNDS
ACCOMMODATION—UP TO 70 PASSENGERS



The Shetland flying boat is Britain's largest plane; it can fly nonstop from London to Bombay—4650 miles

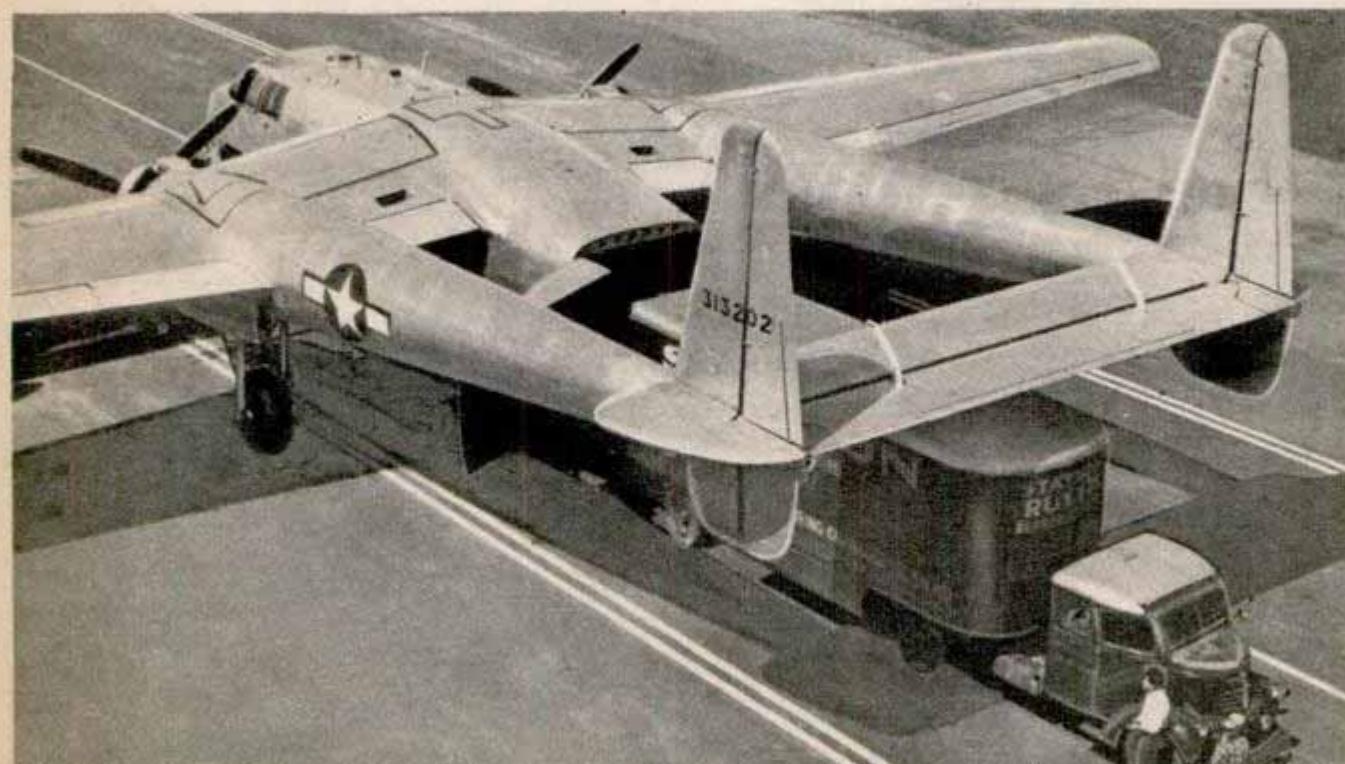
watched out of the rear observation car on your last train trip? The rails were resting on tie plates and spikes fastened them to the ties. The ties were spaced about 20 inches apart—and there were thousands upon thousands. Then there was the ballast of crushed stone or cinders. Every so often you would pass a turnout switch or a frog, a ground signal or overhead semaphore. At intervals you would rumble over bridges and then ride through tunnels.

All this equipment must be inspected

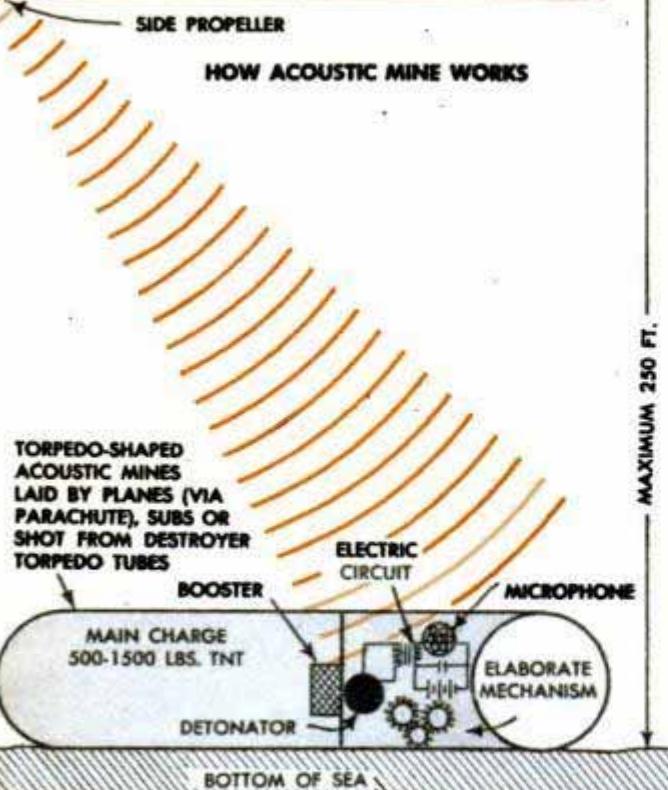
and serviced regularly. Rails and ties must be replaced when they wear out. The roadbed must be replaced or rebuilt on occasion because of accidents, washouts and storms. Capital was borrowed originally to build or replace those facilities and equipment—and interest must be paid on that capital, year after year.

But air cargo has the free, unobstructed and boundless roadway of the air that requires no servicing, no maintenance, no replacements and no interest charges.

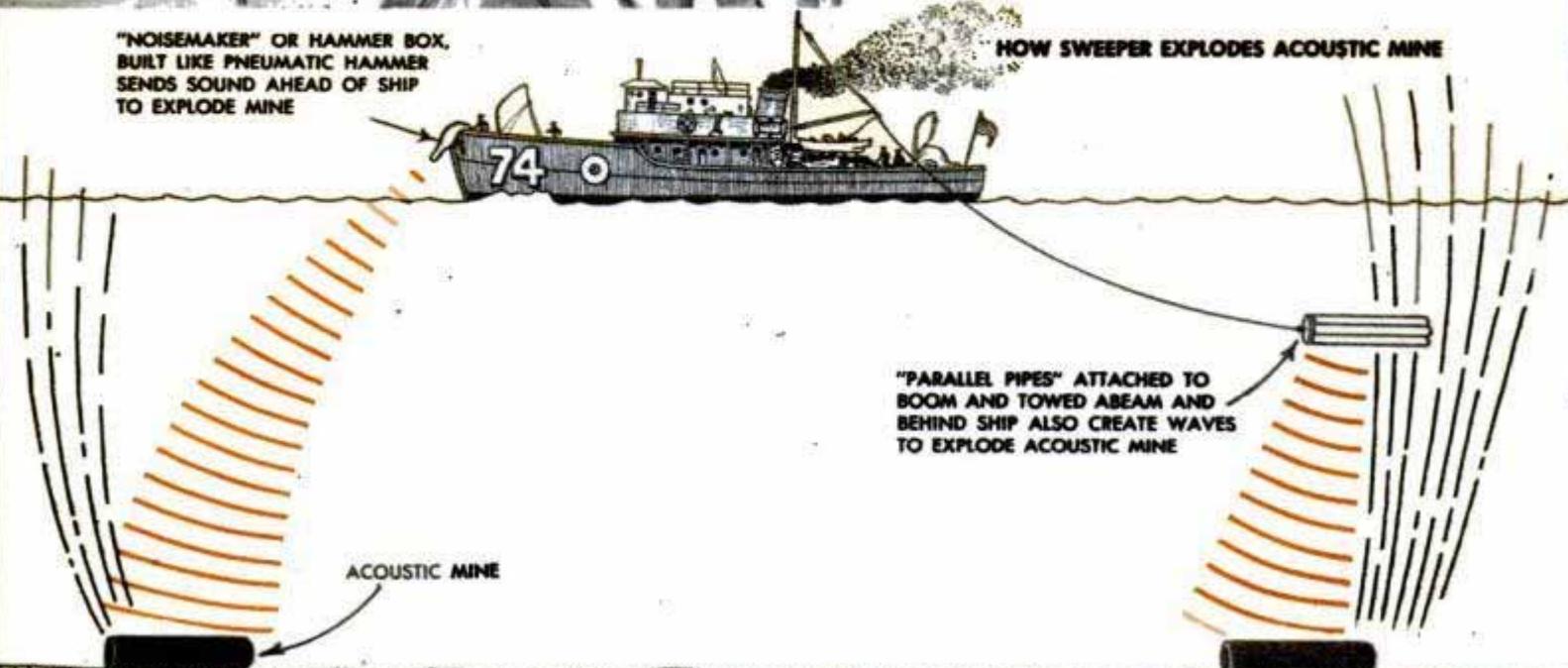
Trailer truck unloads directly into cargo compartment of Fairchild Packet by backing under twin-boom tail



Sweeping Up Sudden Death



"NOISEMAKER" OR HAMMER BOX, BUILT LIKE PNEUMATIC HAMMER SENDS SOUND AHEAD OF SHIP TO EXPLODE MINE



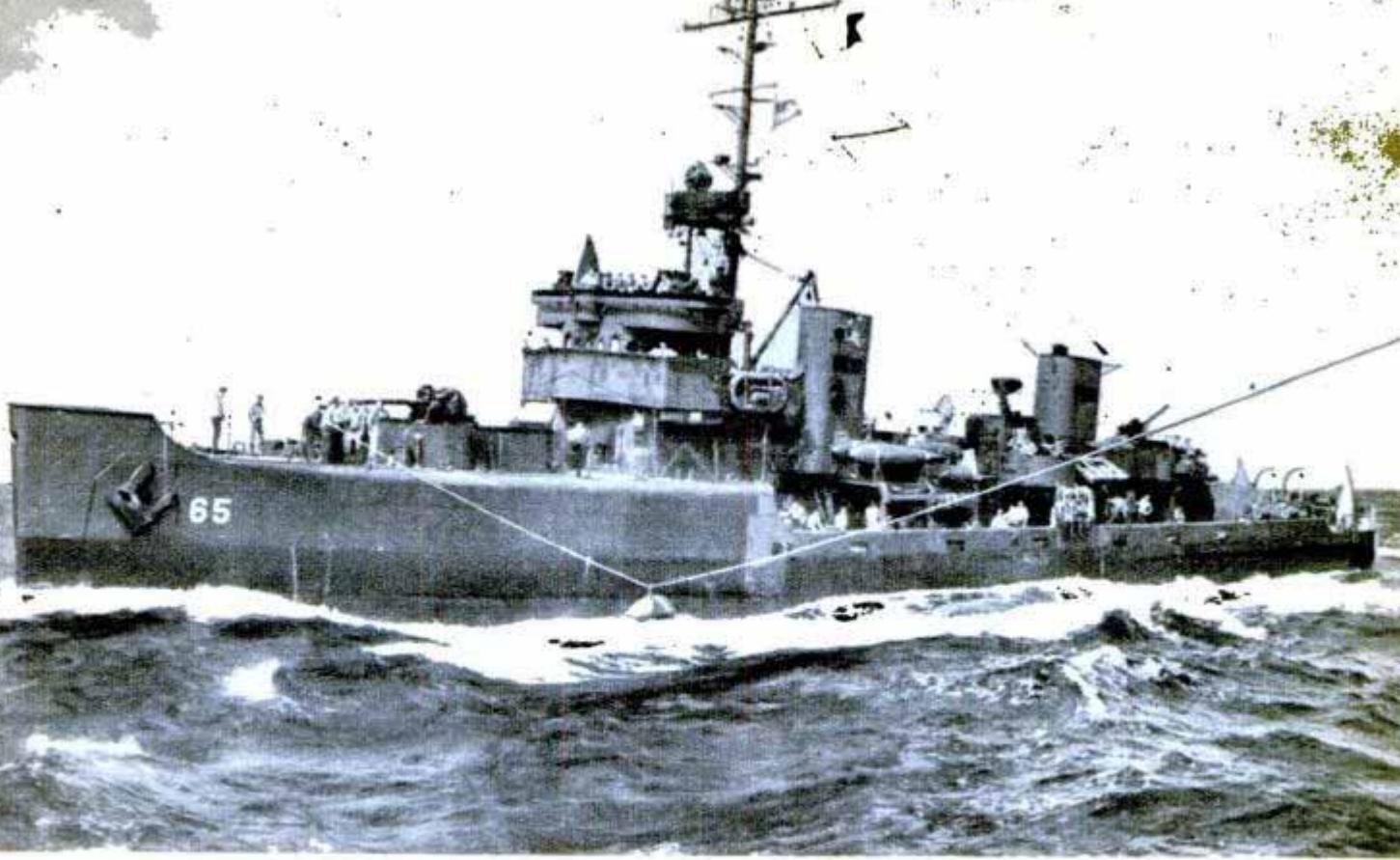
THE BLOODIEST war in history is at an end. But a hardy little fleet of United States ships and men is still in daily contact with Japanese destruction and death.

They are the Navy's minesweepers and the rugged young men who sail them. "First in—last out" is their motto. Having spearheaded amphibious landings in Europe and the Pacific, minesweepers now are engaged in the dangerous duty of clearing unexploded mines from waters around Japan, Korea, the China Coast, Formosa, the Dutch East Indies and Malaya.

Jap minesweepers, men and equipment are being used as much as possible, but because most of the Jap ships were sunk, the United States and British navies also must pitch in and help. It is a slow and difficult job that may take several years.

United States minesweepers in 1942 and 1943 cleared 62 mines from the Atlantic seaboard that were laid by German submarines. They swept 1933 mines from the Mediterranean and North Sea. It is estimated that the Far East will be the biggest job of all—with perhaps as many as 15,000

←Lowering a noisemaker over side of British minesweeper to explode acoustic mines in European waters



USS Swallow, one of Fleet's "scrubwomen," takes time out to pass mail with heaving line to another ship

mines to be found and rendered harmless.

The Japs laid down extensive minefields to protect bays, harbors and rivers around their home islands and Far Eastern naval bases. In the final weeks of the war, B-29s and Navy land-based planes sowed so many aerial mines (12,000) that the battered remnants of the Imperial Navy couldn't budge, and became sitting ducks for Admiral Halsey's mighty Third Fleet.

As soon as the shooting stopped, the minesweepers went to work, carrying out a job as important as it was dangerous. The men of the minesweepers knew that unless mines were swept up and exploded, the lives of Army garrison troops on transports, sailors with the Navy and merchant seamen aboard tankers and freighters would be endangered.

Minesweeping rates second only to submarine duty in the Navy as a hazardous occupation. Crews are highly trained specialists in the man-killing art of mine disposal as well as skillful seamen and navigators. They wear special insignia on their uniforms and are fiercely proud of their ugly little ships.

Minesweepers are affectionately—and sometimes not so affectionately—called "sweepers of the sea," "scrubwomen," "charwomen of the fleet." They range in size from tiny, 100-ton tuna fishing boats to 1190-ton World War I flush-deck destroyers which have been converted into high-speed minesweepers.

At the present time the Navy has several

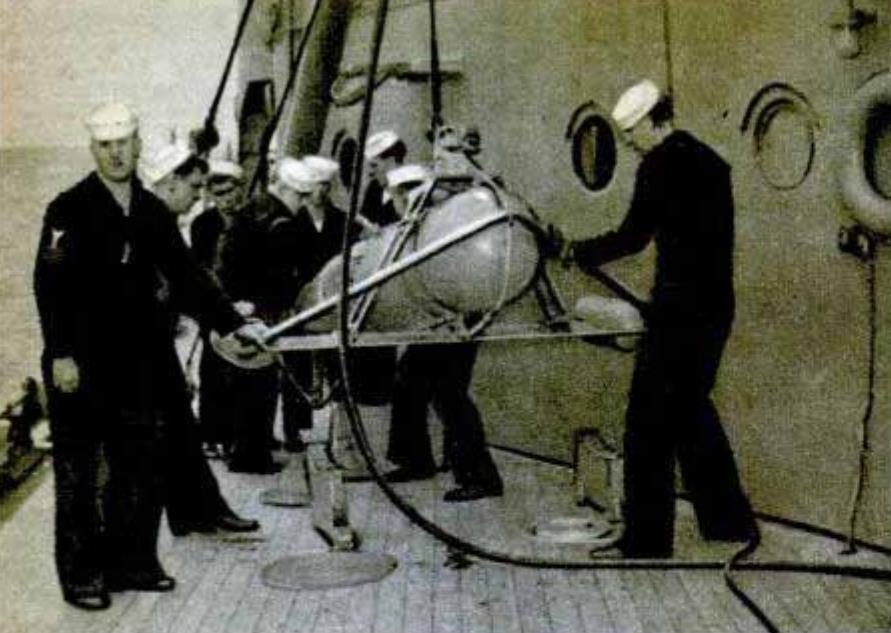
hundred minesweepers, divided into four categories: (1) motor minesweepers, (2) coastal minesweepers, (3) fleet minesweepers and (4) high-speed minesweepers.

Mines are round or torpedo-shaped and carry a charge of TNT varying from 250 to 1600 pounds. They are anchored by cable or lie on the ocean bottom and can be planted as deep as 3000 feet below water-surface and at varying depths to intercept surface craft or submarines. Free-floating mines, prohibited by international law, are of doubtful value because they are hazardous to friend as well as foe and can be spotted easily.

The contact mine is the simplest and perhaps the most widely used. When a ship strikes one of the contact points, or "horns," which protrude from the mine's side, an explosion takes place. Magnetic mines were used with success by the Germans in the early part of the war and took a serious toll of Allied shipping. They are set off by electrical impulses created by a ship's metal hull. Acoustic mines work on the same principle except that they are set off by underwater sound waves.

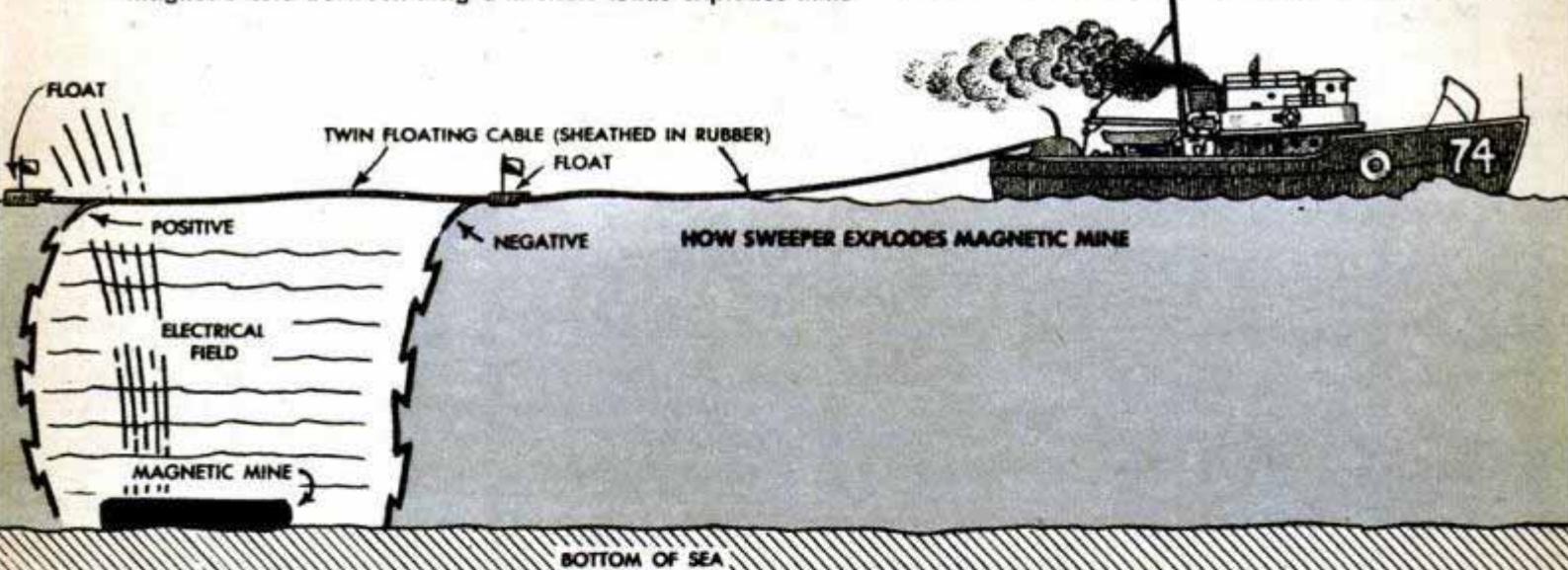
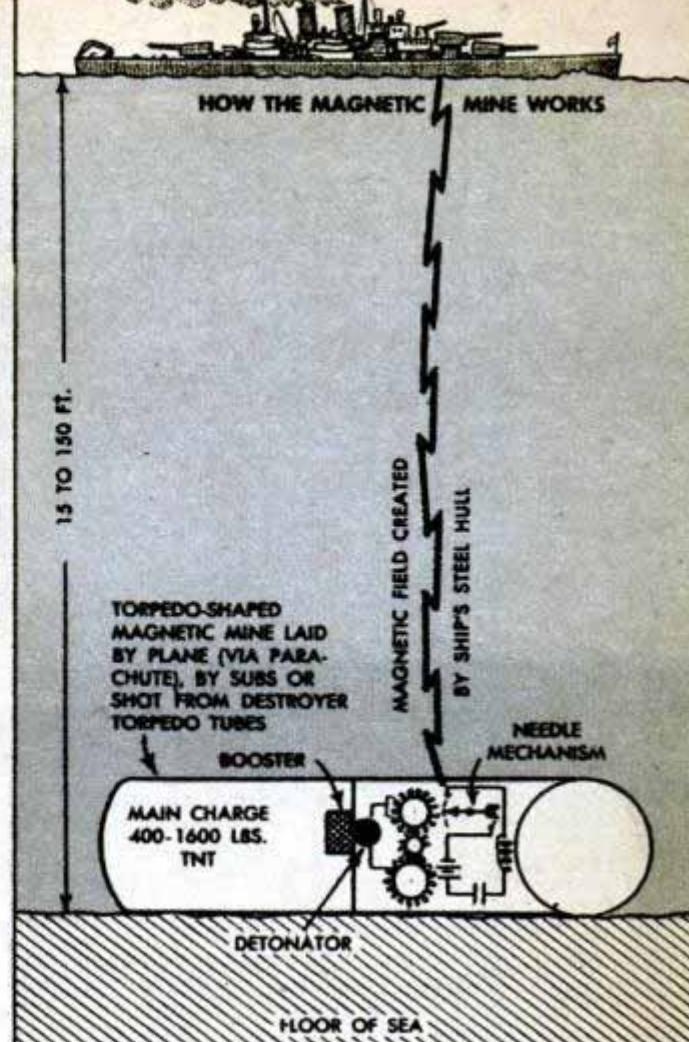
Aerial mining first was attempted by the Germans in an effort to blockade British shipping in the Thames and channel ports. But the Germans did not have enough planes or mines. Later, joint United States Army-Navy efforts in dropping aerial mines by parachute in Japanese waters proved extremely successful.

To explode contact mines, minesweepers



Paravane which holds steel cable towed by minesweeper is handled like a baby by sailors hoisting it aboard. This delicate mechanism holds cable at proper depth and angle

When a ship passes over a magnetic mine (right) the electric field created by its steel hull swings needle mechanism in mine. This activates the detonator which in turn sets off the booster charge of granulated TNT and the main charge of cast TNT. When minesweeper (below) approaches a magnetic mine it is protected by De-Gaussing cable. Flo-tation cable towed behind is electrically charged so that magnetic field between long and short leads explodes mine



tow long steel cables which are held by paravanes at an angle from the ship and at the required depth below the surface. When the cable connecting the mine to its anchor is caught by the ship's cables, it slides along toward the paravane, where it is cut by sharp knives. The mine then bobs to the surface and is exploded by gunfire.

Magnetic mines are destroyed by electrically charged cables towed behind minesweepers. Acoustic mines are detonated by special devices known as "noisemakers" which send out underwater sound waves.

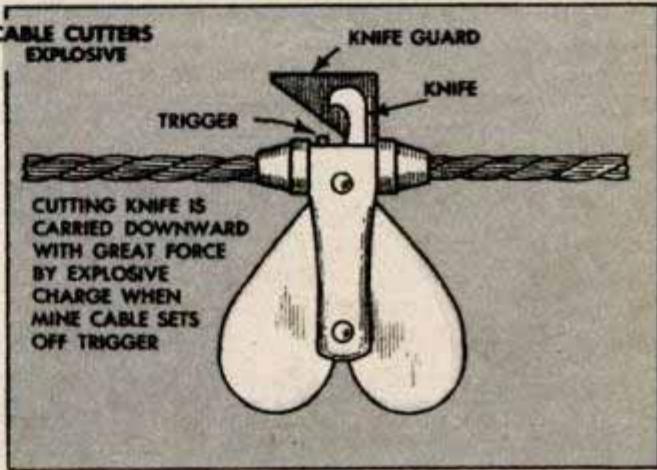
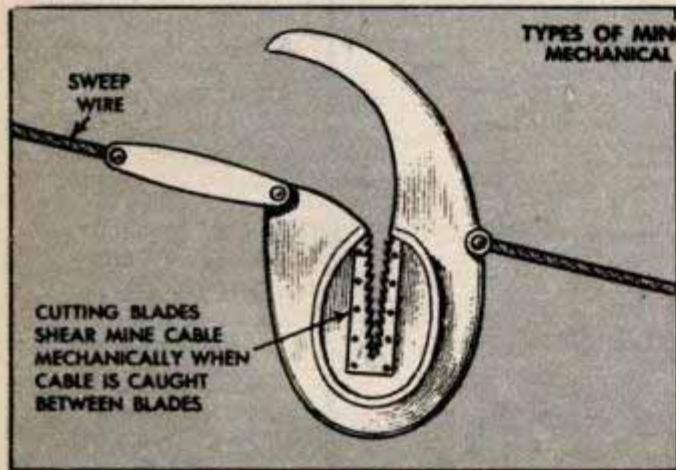
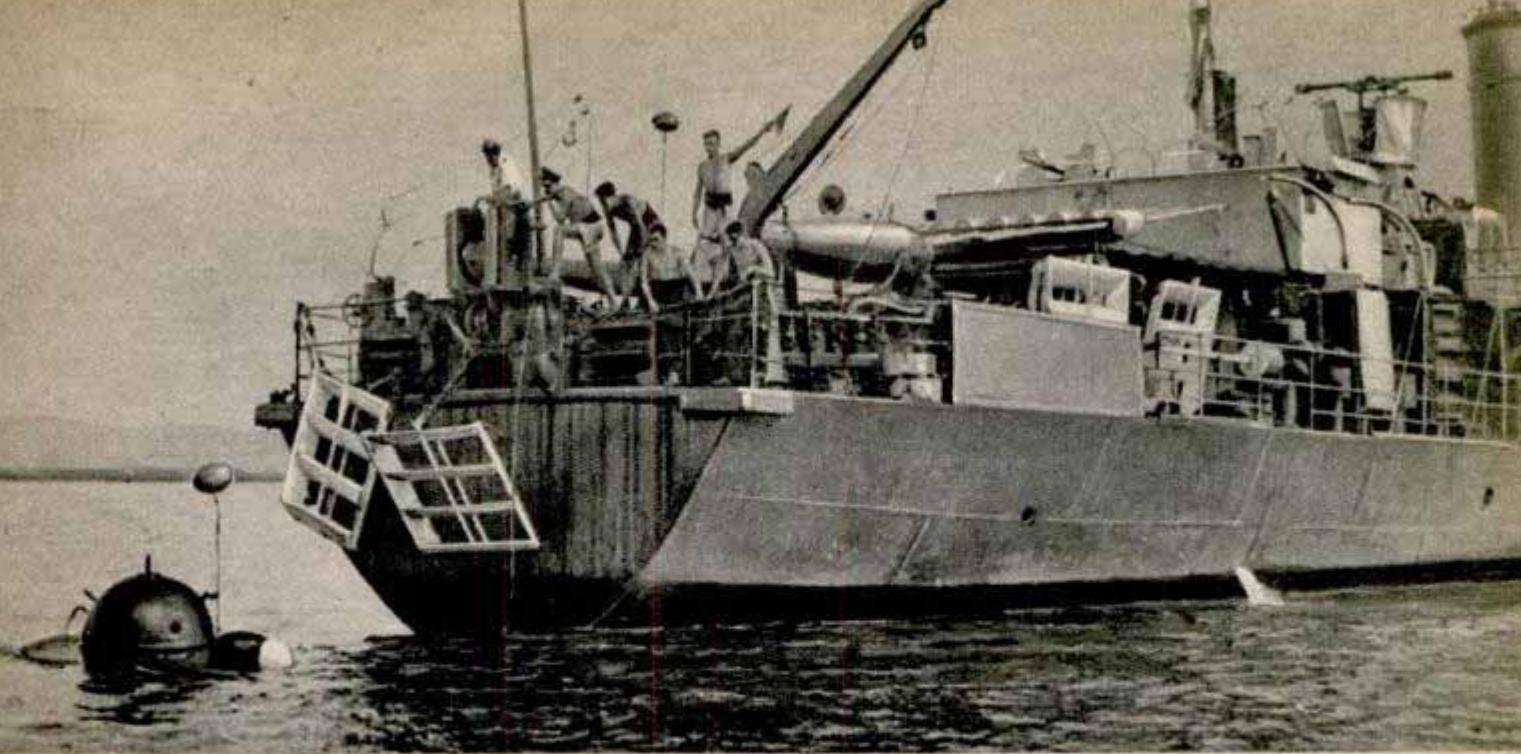
Come aboard a "sweeper of the sea" as it begins operations. The ship is one of a

squadron assigned to sweep a certain designated area. The skipper gives the orders: "All hands to sweeping stations."

The men move quietly and efficiently. Trained under battle conditions where the slightest sound might betray the presence of the ship to the enemy, the skipper gives his commands by telephone:

"Out sweep."

Over the stern goes the float. Its little flag trails almost out of sight in the milky green-white wake of the ship. Then the paravane slips off its launching tray and the sweep wire begins to play out. The man at the winch reports when it has reached



a depth of the required number of fathoms.

Everything is quiet except for the steady thrum of the ship's engines. Everyone is nervous—waiting for the blast that will indicate sweeping of the first mine.

Suddenly the sweep wire becomes taut. A black, wicked-looking mine bobs to the surface and the ship's 3-inch gun cracks. Then there is a rumbling sound and the explosion pressure breaks the surface with an ear-shattering "whoomph." A tower of white water rises high into the air and the little ship tosses to the concussion of the blast. The first mine has been destroyed.

The original tenseness subsides as the men buckle down to their work. One mine after another is exploded and the area finally is pronounced cleared. The job is over and the skipper winds it up with:

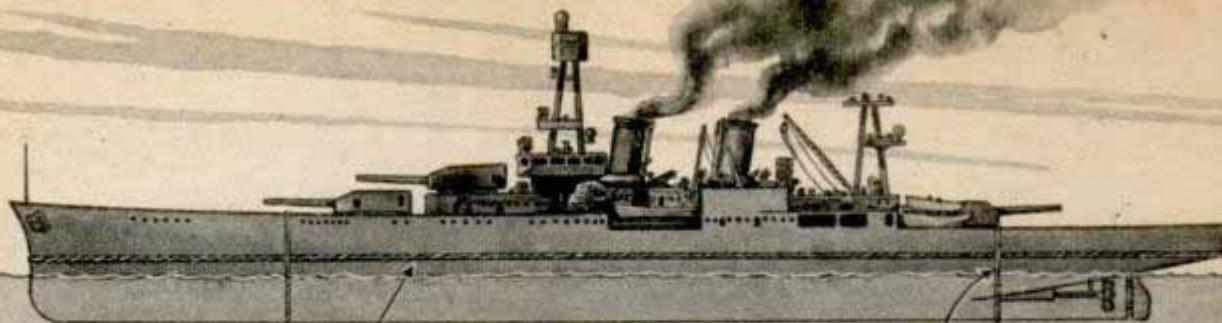
"In sweeps!"

Mine warfare is not a modern development. In fact, it is more than 350 years old. It came into being in 1585 when the Dutch destroyed 800 Spaniards during the siege of Antwerp by using an "explosive vessel" fitted with a clockwork mechanism. During the 17th century the English produced

Crew inspects "catch" (top) as cut mine is drawn in close to British minesweeper. Drawings show cutters. Below, gunfire explodes mine brought to the surface



THE DE-GAUSSING CABLE



ONE DE-GAUSSING CABLE RUNS HORIZONTALLY AROUND SHIP TO COUNTERACT HORIZONTAL ELECTRICAL FIELD SET UP BY STEEL HULL

OTHERS RUN VERTICALLY TO COUNTERACT VERTICAL ELECTRICAL FIELD. A VERY LIGHT CURRENT IS PASSED THROUGH CABLES

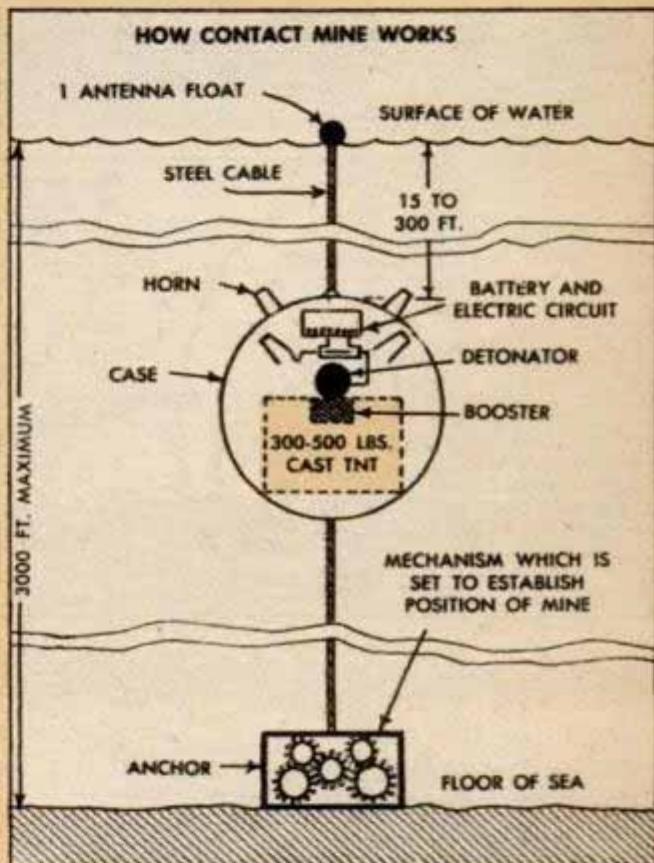
Greatest boon to the minesweeper is the De-Gaussing cable that protects it from the deadly magnetic mine

similar devices which were attached to a ship's hull by a diver.

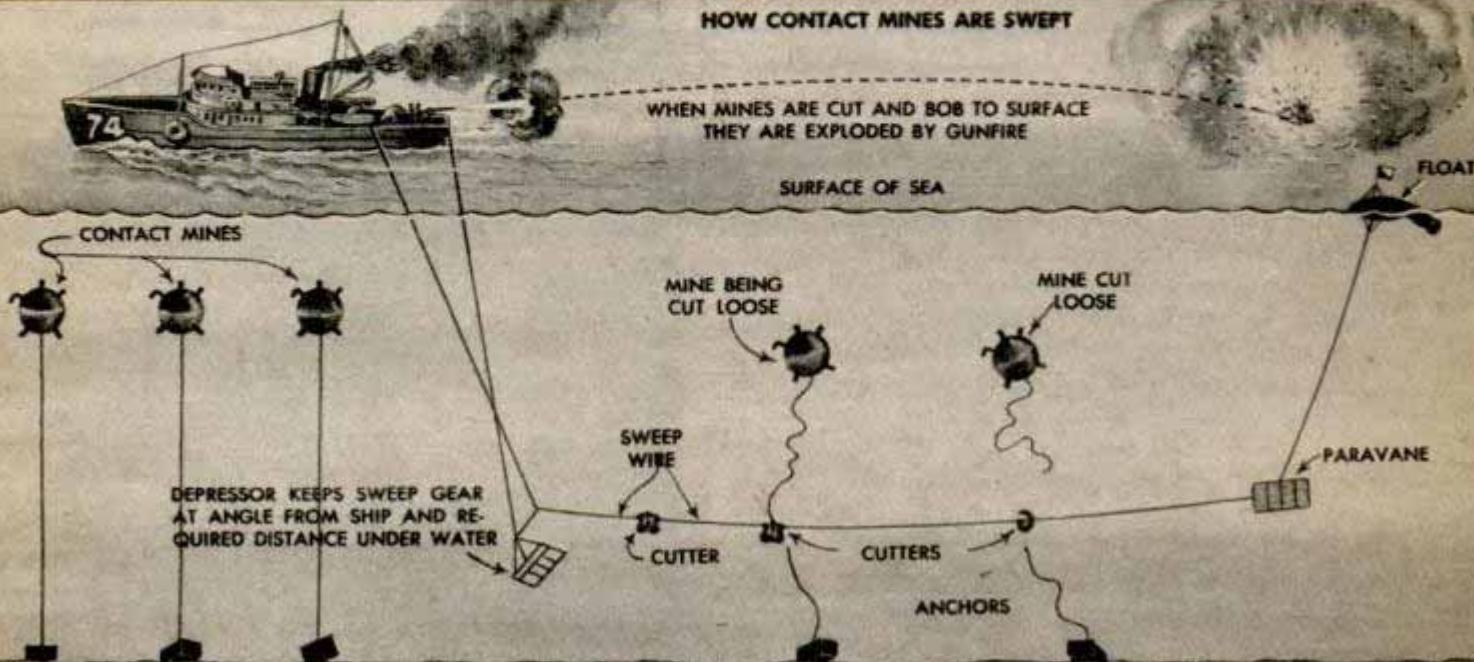
It was David Bushnell, the American inventor, who finally conceived the idea of detonating mines by contact. Twenty years after Bushnell, Robert Fulton began experiments of the same nature. And in 1804, after failing to interest the French, Fulton turned his ideas over to the British.

During the Civil War, the Confederates made extensive use of mines and it was Admiral David Glasgow Farragut who issued the famous command: "Damn the torpedoes, full speed ahead." Actually he used the word torpedo to describe the heavy mine field which the Confederates had planted to guard Mobile Bay. One of the mines had sunk his leading ship as the Union fleet attacked that port.

Many other nations began to make use of mine warfare both offensively and defensively. By the time of World War I it had become an important factor in naval strategy. With World War II came further improvements—notably the magnetic mine,



HOW CONTACT MINES ARE SWEPT



CONTACT MINES
DEPRESSOR KEEPS SWEEP GEAR AT ANGLE FROM SHIP AND REQUIRED DISTANCE UNDER WATER

MINE BEING CUT LOOSE

SWEEP WIRE
CUTTER

CUTTERS

ANCHORS

MINE CUT LOOSE

PARAVANE

SURFACE OF SEA

acoustic mine and aerial mine. Minesweepers were developed as a counterweapon to the mine. In World War II, which saw so many amphibious landings by Allied troops, the minesweeper played a vital role.

Several hours before assault troops hit the Normandy beach on D-day, the minesweepers were close inshore. Gear splashed into the Seine and the minesweeping squadron began its run back and forth in front of the landing strips where infantry would go ashore.

"The enemy on shore could see us," said one of the skippers, "but he was so busy dodging bombs from our aircraft that he couldn't do much about it."

The squadron completed the task of clearing a channel for supporting cruisers and destroyers only a few minutes before the men-of-war opened their barrage.

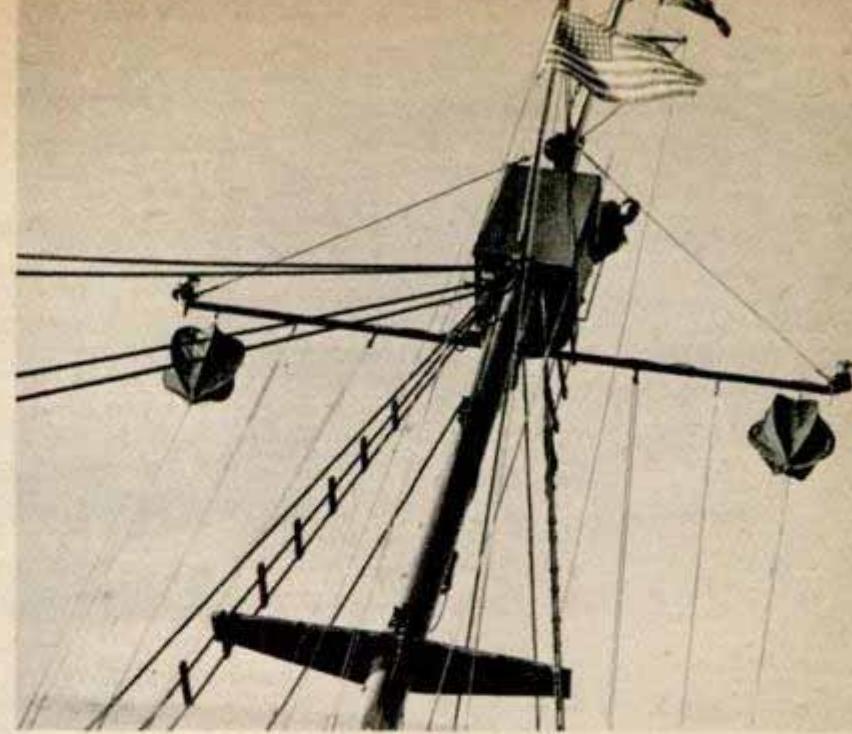
"We got out of the way then," said the minesweeping officer, "and enjoyed a box office view of the shelling which made up for all our earlier efforts."

At Iwo Jima a squadron of 136-foot motor minesweepers swept back and forth under enemy guns on Mt. Suribachi two days before the Marines fought their way up the beaches of the Jap-held island.

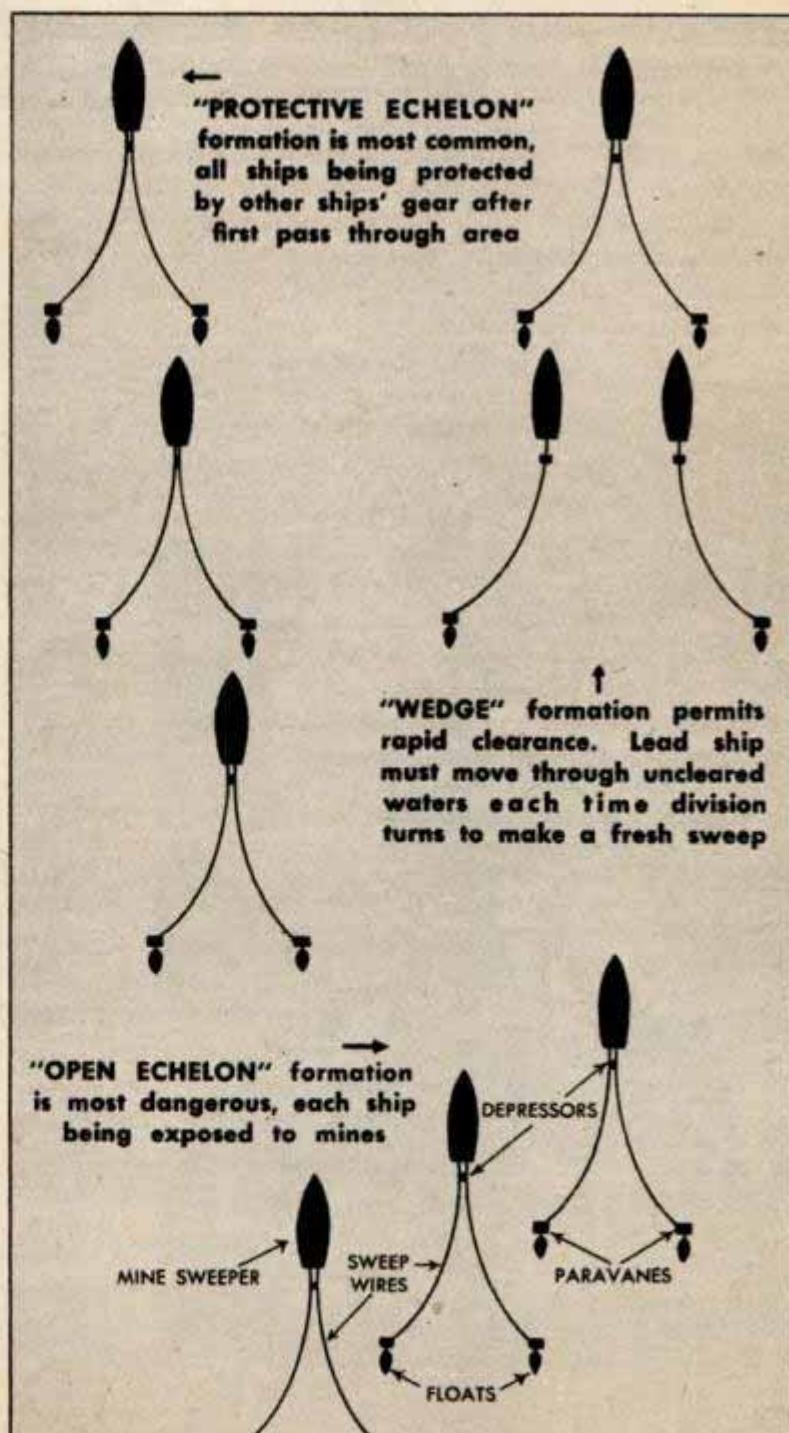
The minecraft worked under cross-fire from Jap batteries on shore while the shells of the United States battleships and cruisers thundered overhead. The little ships went within a half mile of shore, and later were reported by the Jap radio as an "invasion fleet" which was "repulsed."

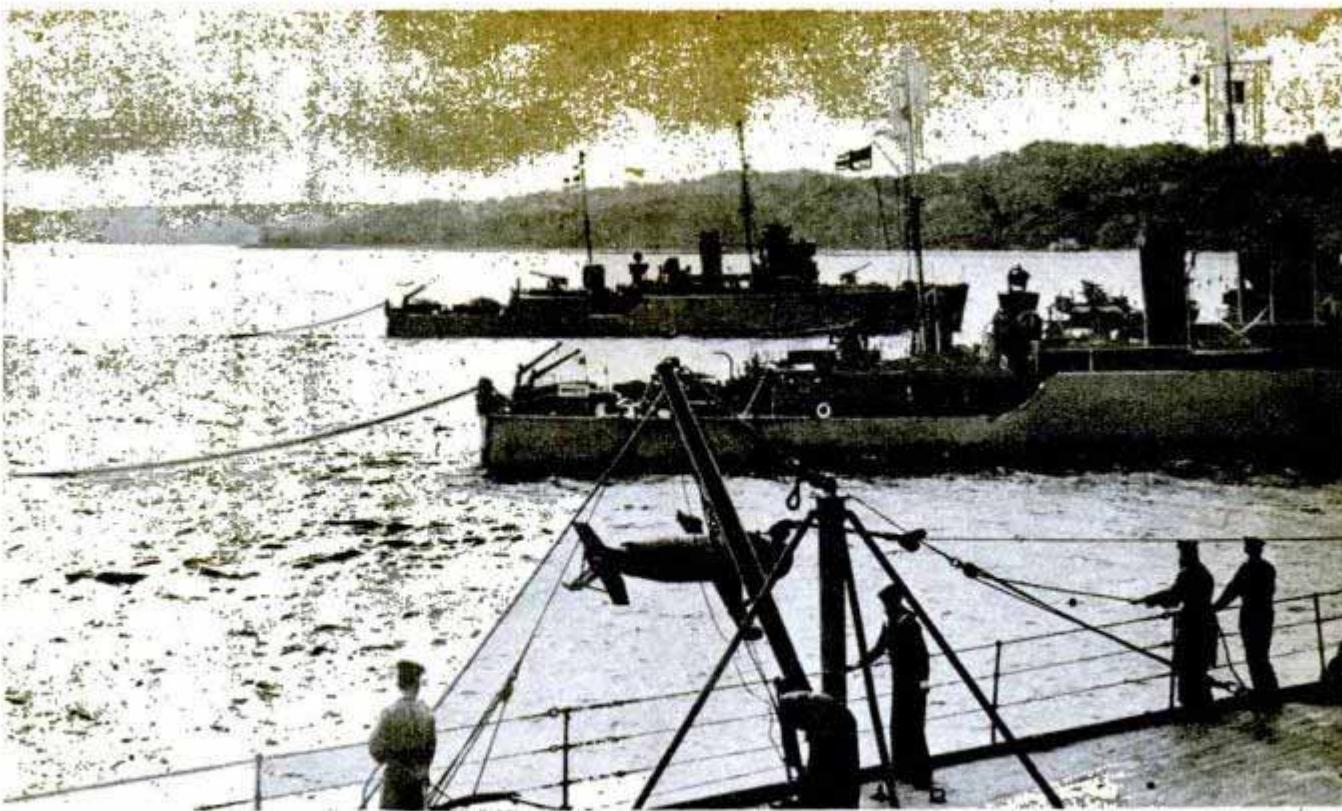
In addition to sweeping, the "charwomen of the fleet" have been used to guard shipping lanes, ride herd on convoys, perform antisubmarine work, and as tugs, traffic control vessels, rescue craft and patrol vessels. Most of their operations are dull, dirty and dangerous, but occasionally they have had the chance to perform deeds of valor usually reserved for their more glamorous sister ships.

In the critical days of antisubmarine warfare in 1943, many fleet minesweepers escorted convoys to British and Mediterranean ports. One of them rescued 100 sailors from a torpedoed French tanker. Pulled aboard, wiped clean of oil and given hot coffee, the French-



High in the crow's nest, a minesweeper bluejacket watches





Magnetic field of flotation cables behind two British minesweepers explodes magnetic mines in 10-acre area. Below, sailors haul in heavy cable which helped explode scores of magnetic mines laid in European waters

men promptly sang the "Marseillaise" in honor of the minesweeper's crew.

Minesweepers that swept a channel off Sicily before the landings engaged in a running fight with shore batteries. At least two batteries were put out of commission, but none of the valiant minecraft was hit.

In the Pacific, minesweepers had to venture into uncharted waters, risking the hazards of reefs and coral heads as well as mines. And at night the Japs came over to

drop bombs to add a third hazard to mine-sweeping duty.

In spite of their dangerous role, only a score of minecraft was lost in World War II. Most of the sinkings were due to enemy mines, but there were also losses caused by bombing, collision and hurricanes.

The sinking of the YMS-39 is an example of the hazards connected with minesweeping. The little ship was cruising back and forth off Balikpapan, Borneo, when it struck a Jap mine.

"Everything went boom!" said the commanding officer. "The explosion struck amidships and cut us squarely in two. The sweeping gear activated two other mines and the triple explosion blew the ship out of the water and rolled her over. She sank in 10 seconds."

So the war is not yet over for men of the Navy's minesweepers. Sweeping sudden death from the waters of the Far East will continue until the last Jap and United States mine is removed and navigation once again becomes safe.



Baseball Grenade Sprays Tear Gas

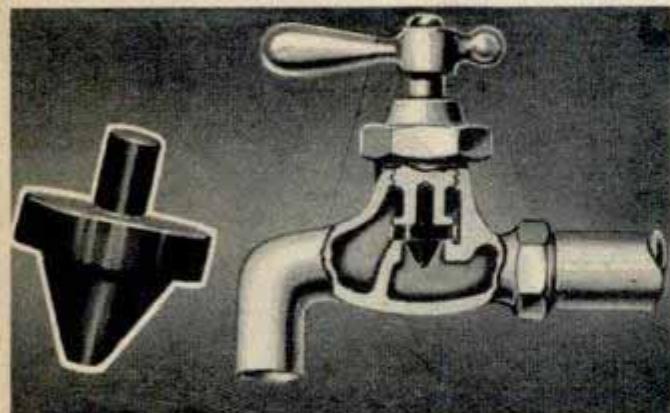
Built like a baseball, a new grenade has been adopted by the Army's Chemical Warfare Service for use with a new type tear gas. The grenade is grasped with thumb or index finger over a projecting plug. Pulling a safety pin, the soldier throws the grenade exactly as he would a baseball. A two-second fuse explodes a small bursting charge that scatters tear gas in a fine spray.

Glove Drier Protects Welders



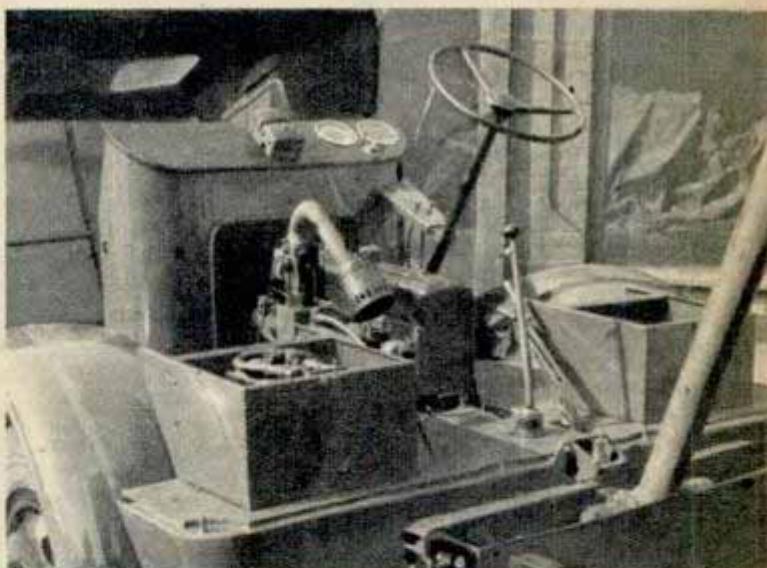
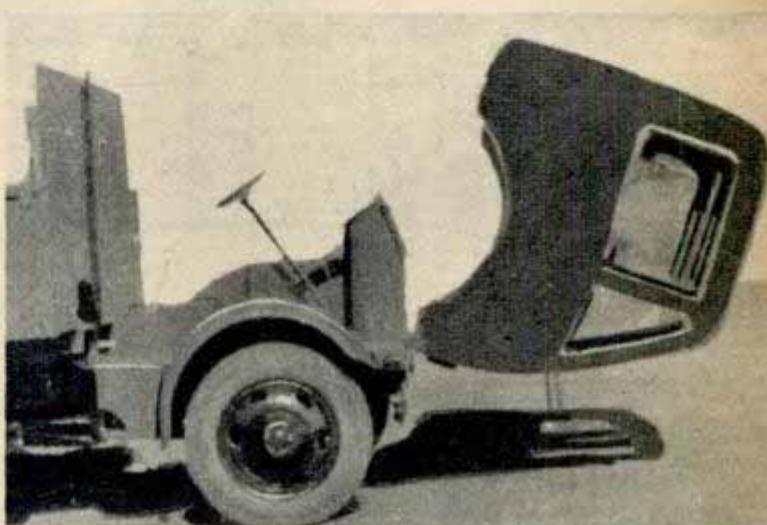
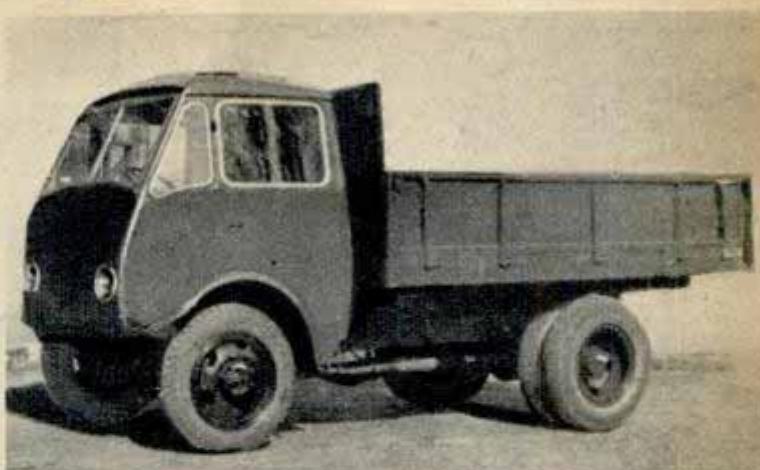
Welders in a Detroit automobile plant are protected from electrical shocks by a glove drier. Perspiration contains salt and the combination with water is an especially good conductor of electricity. Operating on the principle of an auto heater, the unit consists of a drier, fan and spouts over which gloves are draped. Hot air forced through the spouts provides speedy drying.

Faucet Washer Easy to Install



Leaky, noisy faucets can be repaired quickly with an improved washer which is fitted into place with the fingers. The washer has a permanent seat with a positive grip and rotating disk action, assuring long service and eliminating pipe vibration, according to the manufacturer. It comes in three sizes for every faucet need.

Hinged Cab for Motor Truck



Built in two parts, a hinged cab for trucks is tipped forward to uncover the engine. The lower part consists of the floor, engine cover and fenders and the upper part is the cab proper. The parts are mounted with a hinged joint in front of the radiator. When the top is swung forward it rests on a pair of legs which in normal position are flush with the windshield. The cab, designed by G. E. Neville & Son, Mansfield, England, makes the engine easily accessible, usually a problem on space-saving trucks of the cab-over-engine type.

HOMES TO FIT

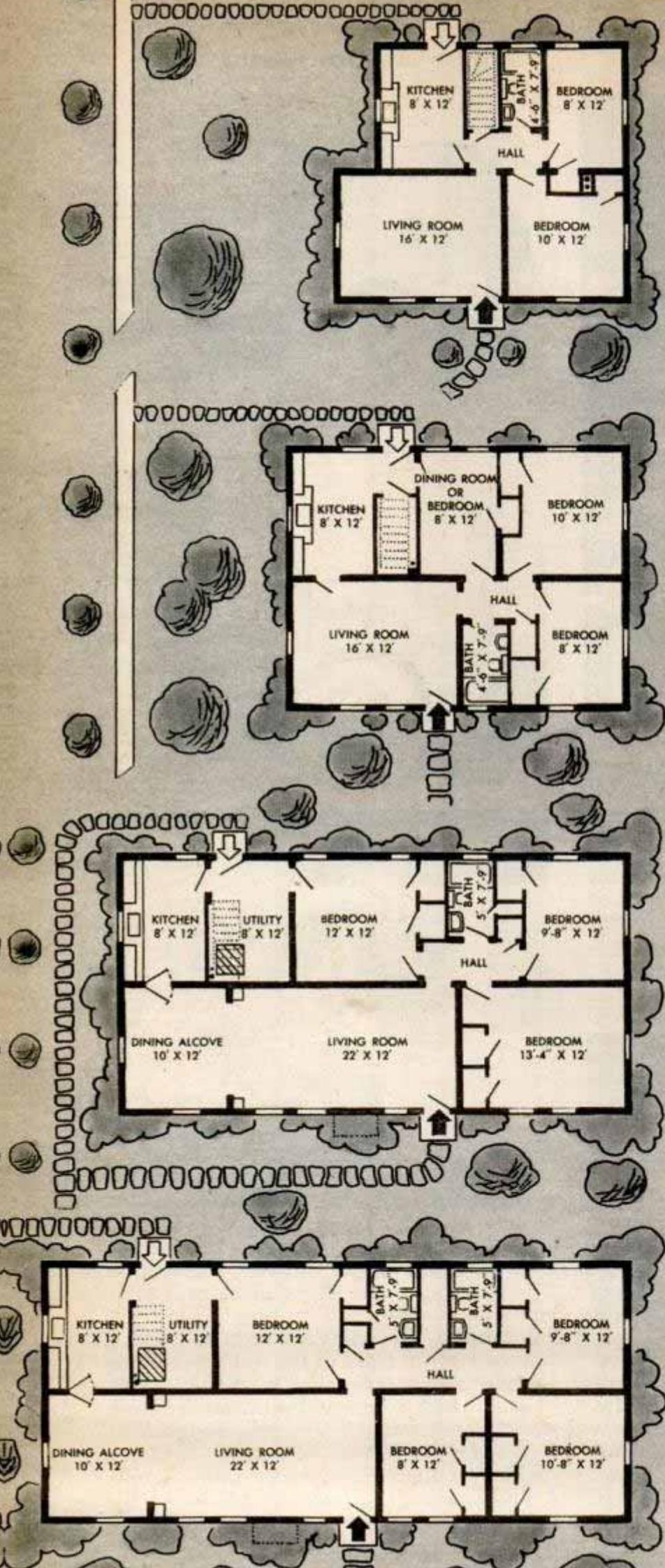
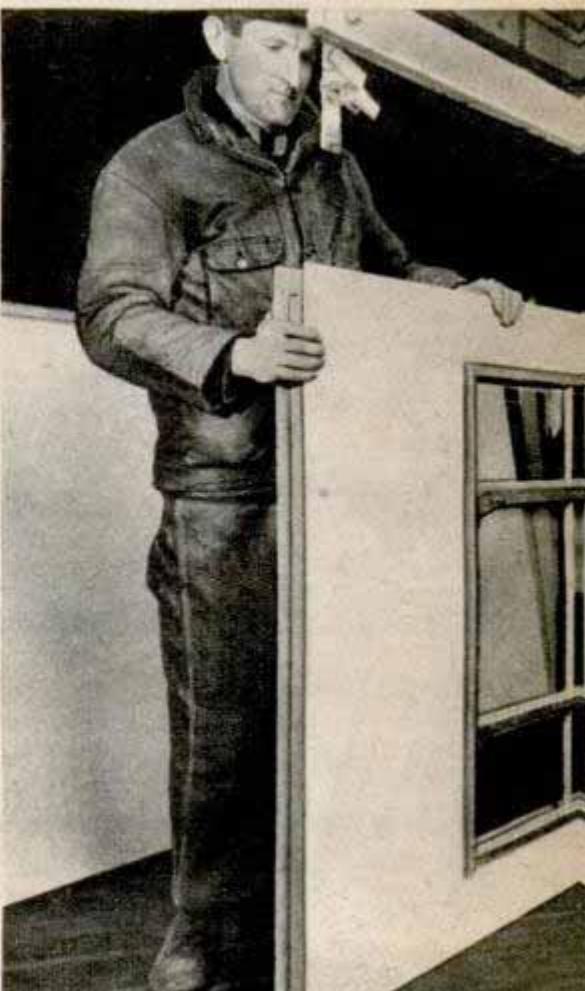
EVERY 25 minutes a home soon will be rolling off the production line in a factory at New Albany, Ind. Not a house all put together and standing up, of course, but sturdy floors, walls, ceilings and roofs—in section form—all ready to be put together by the time you can change your address.

On that shaded lot of yours, workmen can erect this home in one day. Fixtures are installed, porches added, and the place is ready to live in a week later.

This result of science and mass production is not only a well built, rugged, efficiently planned structure but a livable home with charm and distinction.

Available in eight sizes, pre-fabricated homes built by Gunnison Homes, Inc. (a subsidiary of United States Steel Corporation) range in price from around \$3500 to \$9000. When its new \$1,000,000 plant is completed by the middle of this year, Gunnison will increase its capacity

Gunnison prefabricated homes are available in eight sizes; these are typical plans

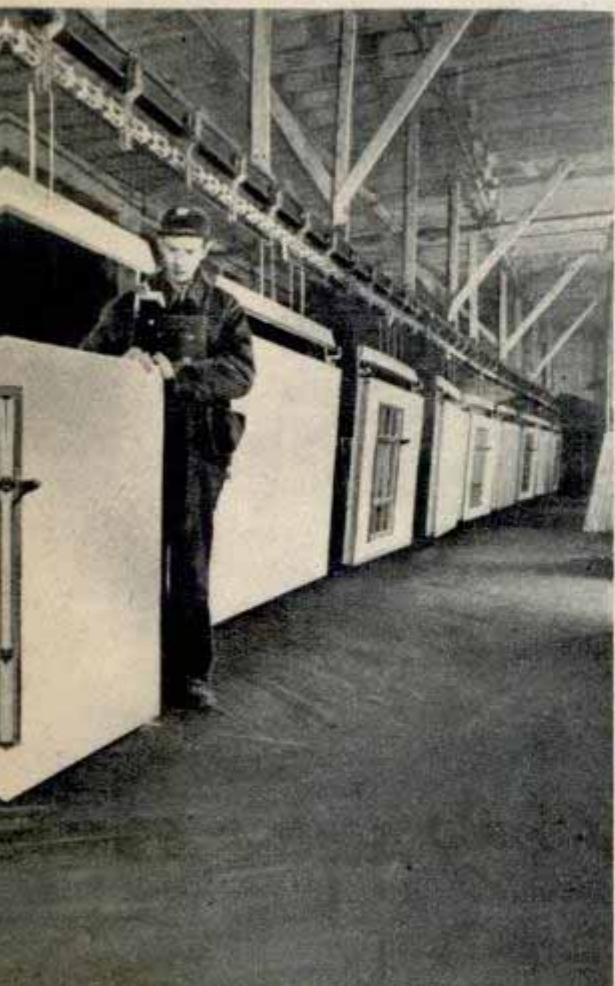


THE FAMILY

1650 houses a year, on an 8-hour production basis, or 3200 on a double-turn schedule.

The Gunnison home is assembled from interchangeable hardwood panels, built up in layers and with a sheet of thermosetting phenolic resin placed between each layer before the whole panel undergoes a chemical conversion process in hot-plate presses. The final result is a combination of wood and plastics which Gunnison engineers report is stronger for its weight than steel. It is waterproof, more resistant than metals to heat and cold, and inert to acids, corrosion and bacteria. All panels, including floors, exterior walls, ceiling and partition panels, have chemically treated rock wool bat insulation sealed within them.

Doors and windows, also assembled at the factory, reach the home site all set in special panels, with no cutting or trimming required. Two coats of white paint are applied to the exterior at the plant and a third coat is added after the house is assembled.



Screened-in porch, gay shutters and window boxes add charm to a factory-built home. Below, interior walls paneled in hardwood



Wall panels at left, with space for windows, are mass-produced at New Albany, Ind. Small home (below) sells for about \$3500





Kitchens have washable waterproof white walls which may be tinted any color. Standard equipment includes steel-trimmed wall and sink cabinets

The Gunnison house definitely is not drab-looking. It bears no resemblance to those "look-alike" dwellings so often crammed into an emergency housing project. Almost unlimited variety in appearance may be achieved in several ways.

For example, every home plan is available in either left-hand or right-hand design. That is, the same general plan can be

color. All walls are waterproof and may be washed with soap and water, although wiping with a waxed rag is sufficient.

House plans range from 4-room dwellings 28 feet by 24 feet to 7-room structures 56 feet by 24 feet. All are for one-story houses. However, the designs are flexible enough to permit prospective home owners to have certain rooms enlarged.

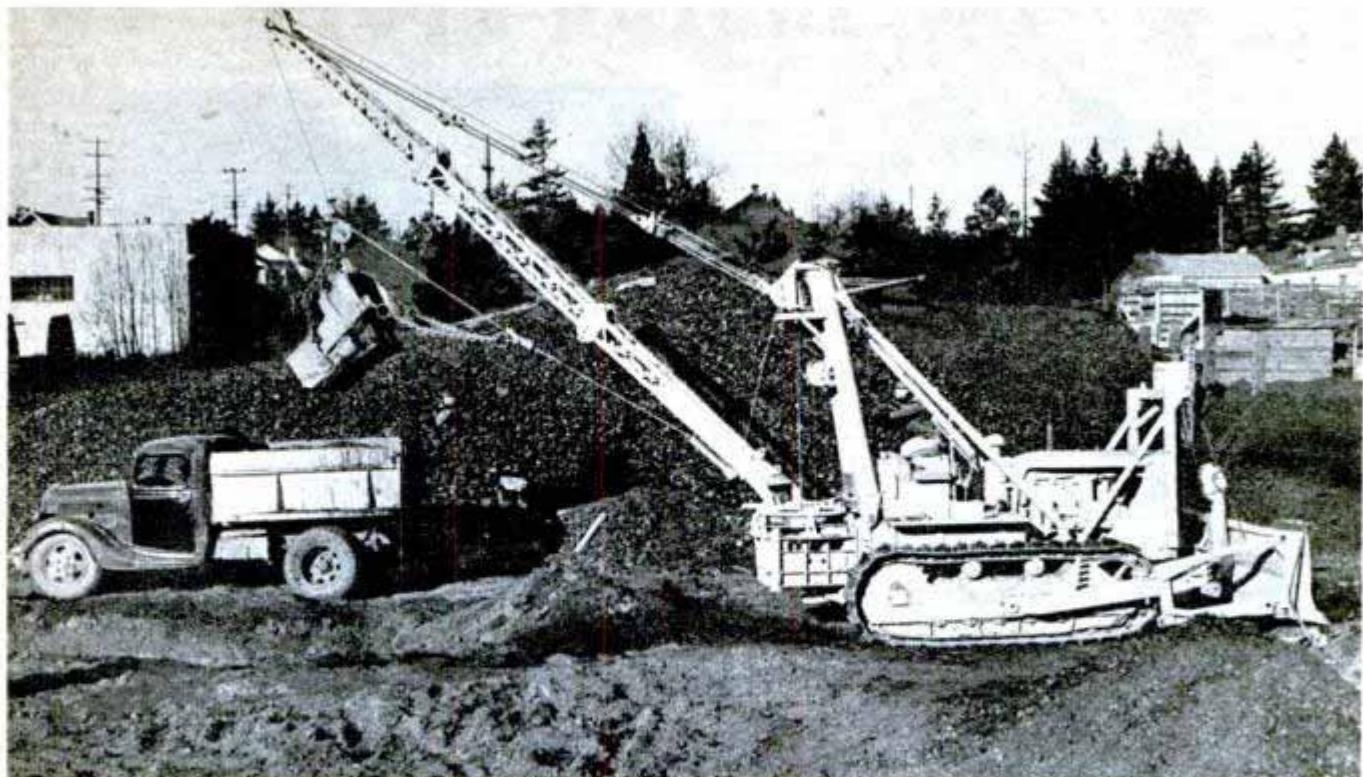
Nestling among trees, a rambling Gunnison prefabricated home provides livability and low maintenance costs



had with the kitchen and dining alcove at either the extreme left or right.

Then there are many standardized accessories and trimmings that can be added: porches, window boxes, wrought iron rails, shutters, arcades and garages. Roofing, window boxes and shutters come in maroon, green or blue.

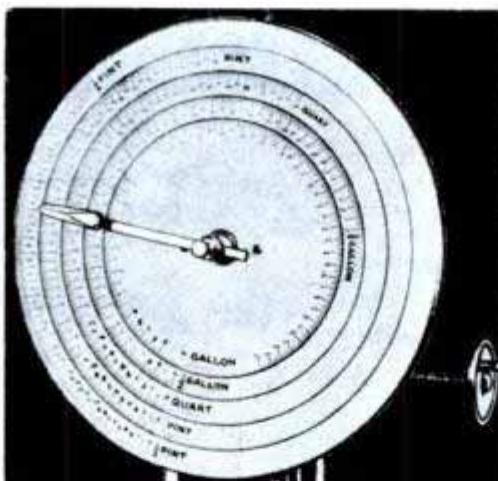
Interior walls are paneled in hardwood—walnut in living rooms and dining alcoves, light mahogany in master bedrooms and gum in other bedrooms. Kitchen, bathroom and utility room walls are white and may be tinted any



Bulldozer-Crane on Tractor

Bulldozer, dragline, clamshell and crane are combined in a unit that can be mounted on a tractor in two hours and removed in less than one. Partial use of the bulldozer

is possible without removing the dragline and crane unit. Movement of the crawler-type tractor is not impeded by the unit. The outfit can be transported by dump trucks or flat-bed trucks from one job to another and has even been carried by plane.



Light Beam Matches Automobile Paints

As little as four ounces of paint for any automobile job can be matched with a "color eye" now on the market. By setting a dial according to a color formula, the amounts of various paints or lacquers required to produce a certain color are indicated on the dial.

Film on Glass Peels When Dirty

Glass panels over lights in paint booths at a Douglas Aircraft plant are cleaned by a novel method. The panels are sprayed with a film which is peeled off when the light becomes obscured. Then a new coating is applied. Formerly the panels had to be cleaned with paint thinner and steel wool.



"INSIDE STUFF" FOR



This Thor electric ironer folds up to occupy only $1\frac{1}{4}$ square feet of storage space. The ironing mechanism is counterbalanced on a tubular steel stand. Below, Whirlpool ironer has knee control to leave hands free to direct materials, also has four-arm rack to hold ironed, folded garments



Westinghouse photo

Electric dishwasher sprays, washes and rinses dishes twice in 12 minutes, cleans and drains itself and automatically shuts off. The dishwasher fits into a work surface next to a sink and holds 28 large dishes, 12 cups, 12 saucers, 12 glasses and a basket of silverware. Below, jar opener, attached to under surface of a kitchen shelf, works on any jar



YOUR HOME

Another postwar appliance is the cordless electric iron which gets its heat from an electrically heated base. With no dangling cord, the user thus has freedom of motion. Various temperatures can be dialed



Westinghouse automatic washers are installed in self-service laundries where women pay 25 cents for 30 minutes' use. The housewife puts clothes in, adds soap, and the washer does everything except iron



Ash tray has safety edge to catch burning cigarettes that fall outward. The entire tray is stamped from a piece of heavy aluminum and the outer edge is wide for safety



Tired of getting out of your car to turn out the garage light? A new switch waits three minutes after being flipped to douse the lights

no cut

Fashion lamps like the one
72 g mutualite lamp

New table lamp has a 32-watt "circline" fluorescent tube and 100-watt conventional bulb to provide ample illumination. This combination is said to avoid sharp contrasts in lighting effects and at the same time provide warmth of color
Chicago Lighting Institute photo

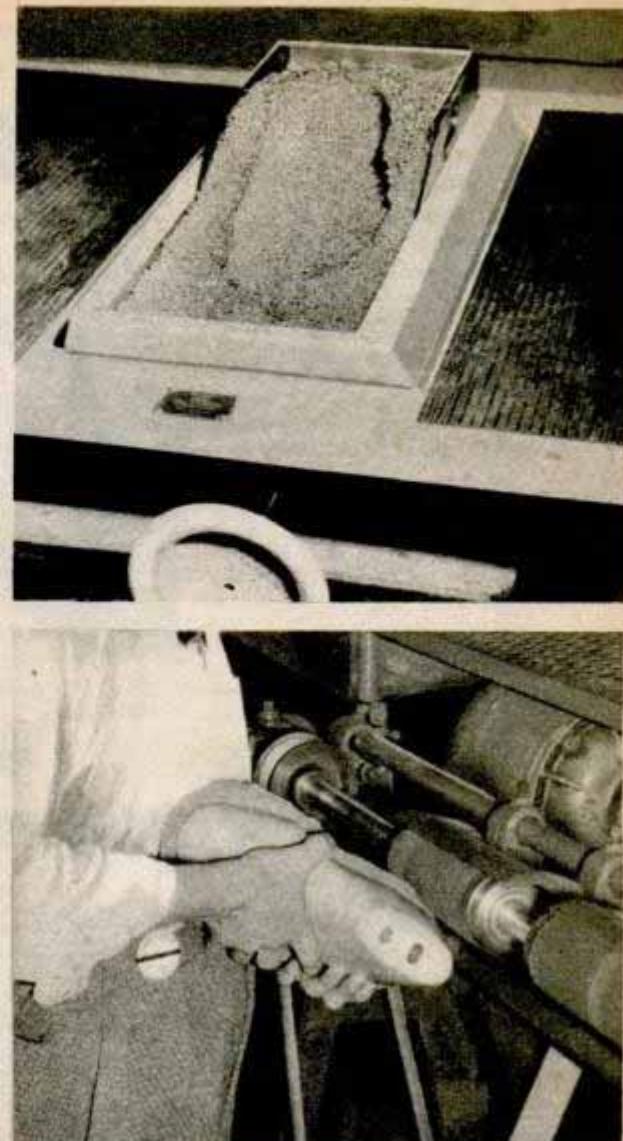




Tiny ball bearings and an electromagnet team up to aid wounded war veterans in finding corrective shoes that compensate for foot injuries or missing toes. Designed by an eastern machine maker in conjunction with the Army Quartermaster Corps, a foot measuring device employs the ball bearings—each $\frac{1}{16}$ inch in diameter—for

Magnet "Freezes" Footprint

taking foot impressions. After the soldier stands on his injured foot in the bed of steel balls, electric current is passed through the impression. This "freezes" the foot mark and provides a perfect pattern for making a plaster cast and later the orthopedic shoe. Cork parts are built into the shoe to take the place of missing members.



Ice Truck Lifts Body To Top of Rail Cars

Icing of refrigerated freight cars is made easy with a high-lift body on a truck owned by a Louisville ice company. The lift boosts the body, containing up to 36 blocks of ice weighing 300 pounds each, to the roof level of the refrigerated car. Operators slide the ice off and drop it into compartments with little difficulty. The same type of truck may be adapted to loading cargo planes.

This aerial camera was made rugged to insure steadiness when pictures are made from an open airplane by photographers of Douglas Aircraft



IT'S TIME TO OPEN THE SHUTTERS



Starvation is over for the millions of camera fans who have been standing in line for film and waiting for new cameras that didn't exist. Take a look at what's coming to the photographic counters. The signs point to fun ahead for film fans!

HOW WOULD you like to have your camera films developed at the corner drugstore in five minutes, while you wait?

Research in the diazo "dry photography" field suggests this possibility within the next few years. A diazo emulsion contains light-sensitive dyes that reproduce a photographic image after a few seconds of exposure to ammonia fumes, doing away with the wet baths and lengthy processing that are

necessary in standard photography.

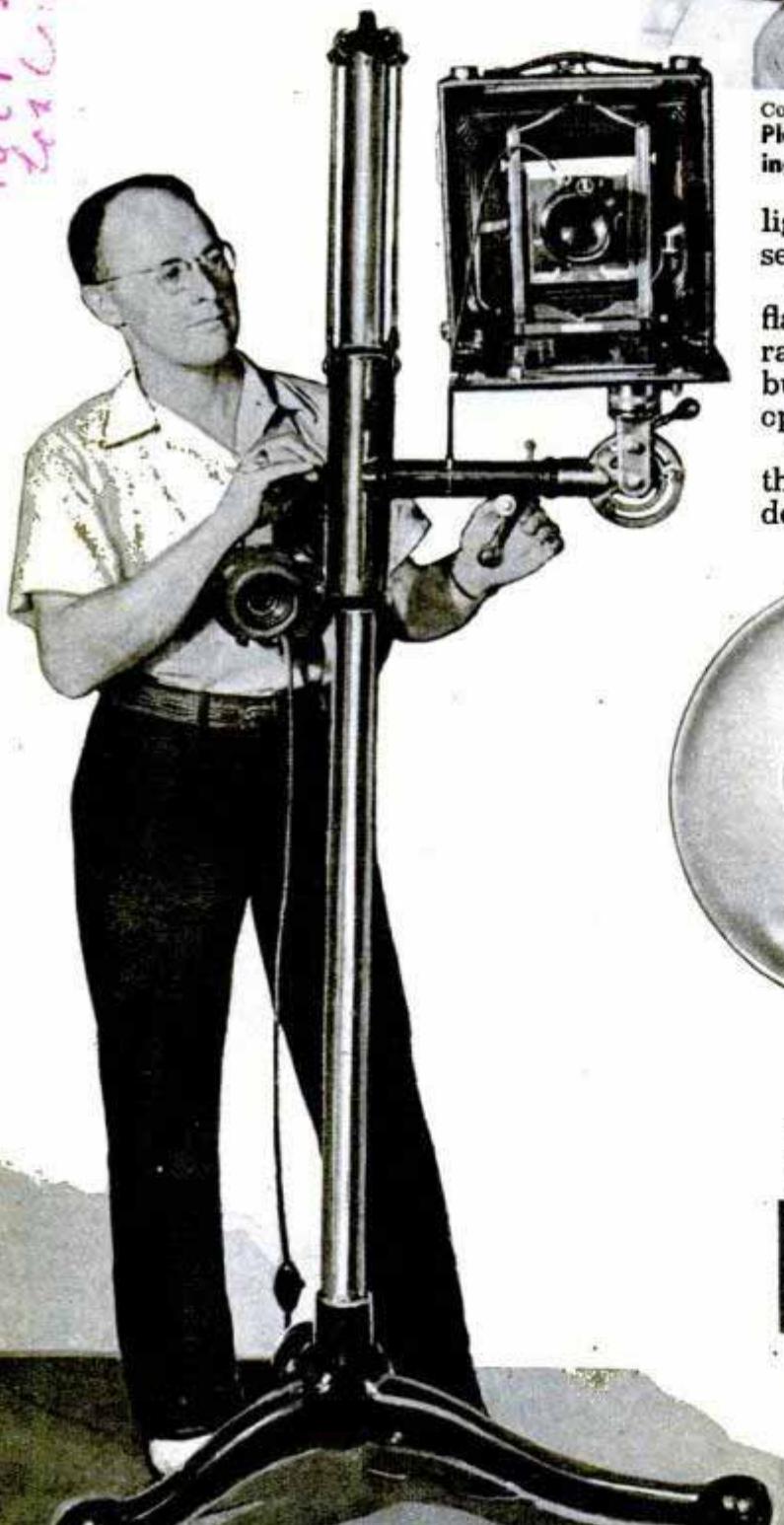
The diazo process is widely used today for the rapid copying of photographs and sketches. So far its use is limited to contact prints, but research is being conducted by the Ozalid Division of General Aniline & Film Corporation in the expectation of widely increasing its versatility. The rapid processing of film that you can use in your camera, converting the exposed film into photoprints within a few min-

utes is one promising possibility.

Aside from the new cameras and improved films and papers that are coming on the market, a whole host of new developments are in the offing. Here are a few of them:

Lightweight optical plastics that can be used to create large lens elements that are now impractical because of weight and cost; a new color process by which ordinary black and white negatives produce movies or still pictures in true natural colors, and a new 16-pound portable speed lamp that you can carry under your arm. It is powered by a small rechargeable wet battery and provides plenty of

Megar Corp
1415 16th St.
Washington



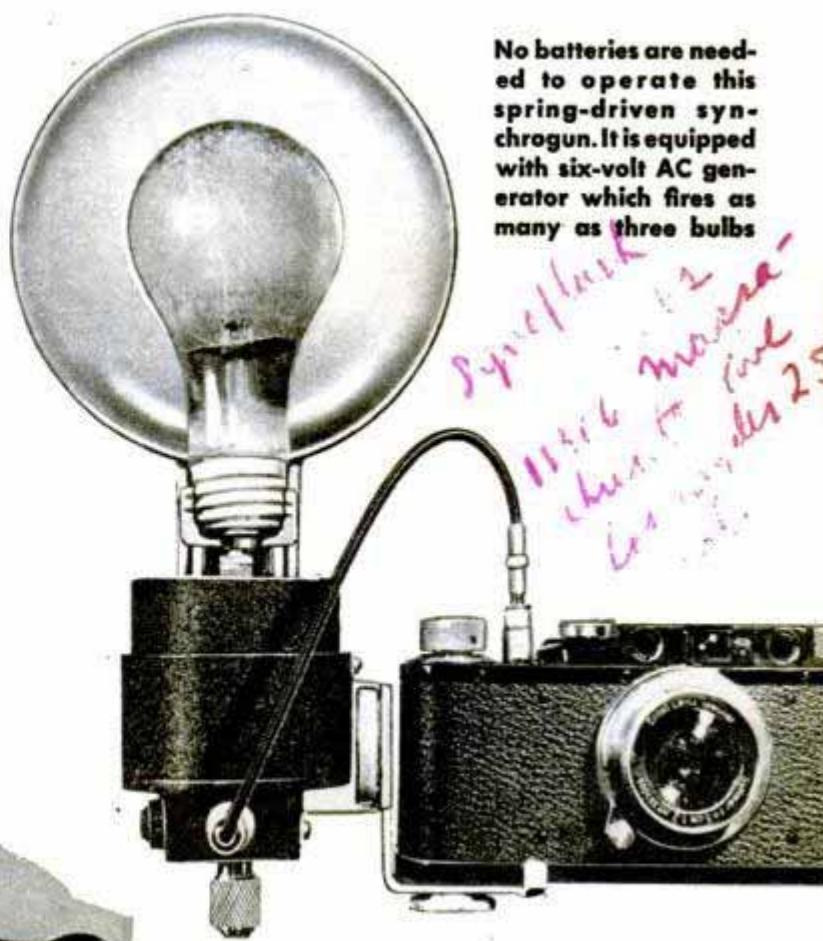
Courtesy Grover Photo Products

Plastic hanger with locking grips holds film during processing. Left, X-ray base used as camera stand

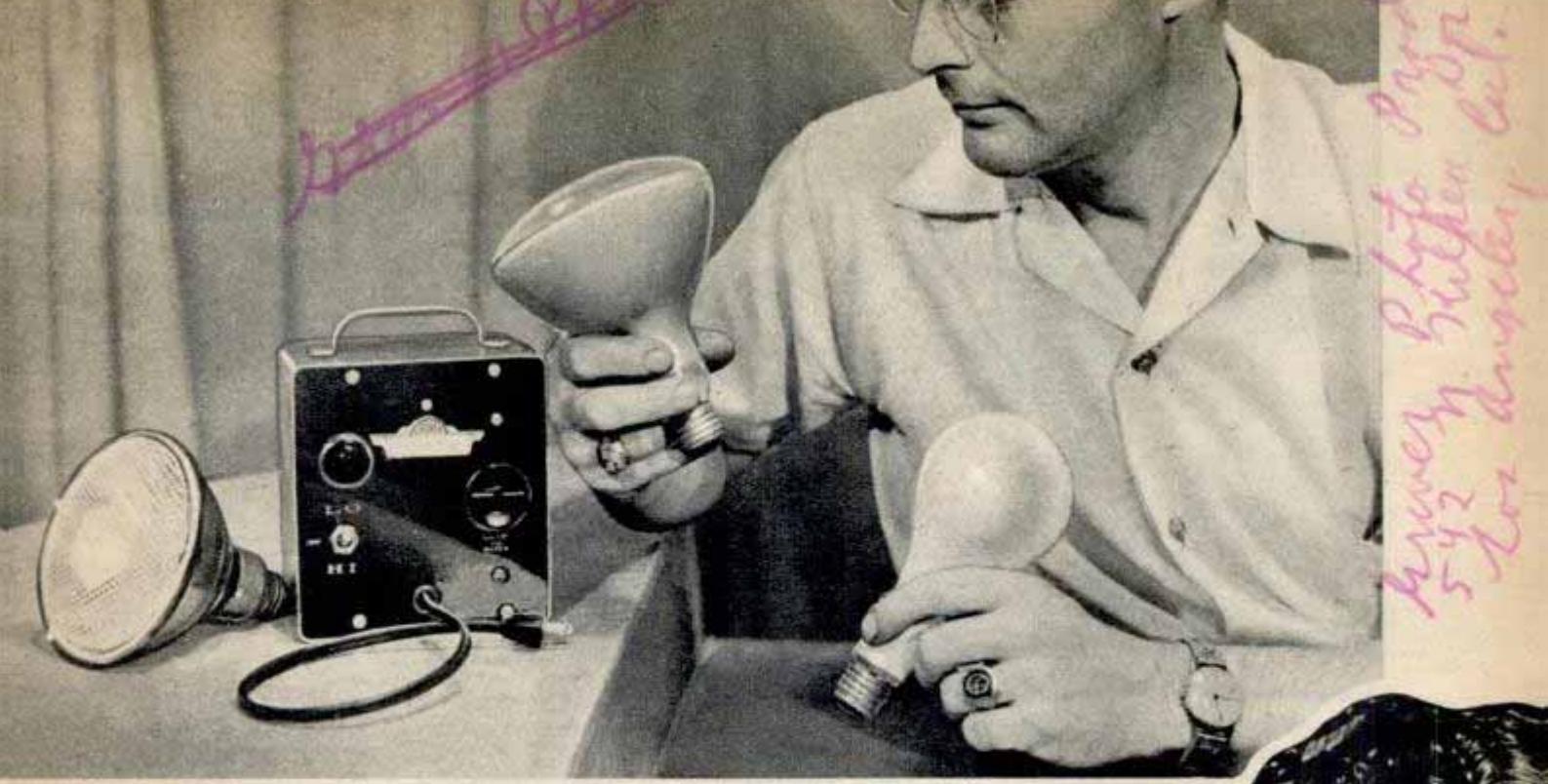
light for stopping action at even 1/10,000 second.

Also in preparation is a short-wave radio flash outfit by which commercial photographers can set off any number of flash bulbs at a distance, synchronized with the opening of the camera shutter.

A synchronized flash outfit, attached to the camera, that uses no batteries and derives its current from a small dynamo



January Photo Eng
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Ordinary light bulbs are stepped up to photoflood intensity by special transformer. Spiral tube (below) replaces flash lamp in reflector for fast shots

Megard Corp. photo



contained in its base is still another development. One turn of a winding knob sets up spring pressure that spins the dynamo when the shutter is tripped, flashing any standard flash bulb in synchronization with the shutter. The outfit can be adapted to any camera, cannot get out of "sync," and weighs one pound two ounces. It generates enough current for use with extension flashes.

New and improved developing tanks for color films and papers, new types of hangers in which negatives are locked so they can't fall out during development, a new optical system for enlarging that avoids hot spots, and a transformer that steps up any standard household bulb to photoflood intensity are a few other items that will be available shortly. The step-up transformer produces light that has a color temperature in the neighborhood of 3200 degrees Kelvin, making it ideal for color photography. Average life of a bulb at the stepped-up voltage is 10 hours.

Plastic photographic lenses are in use although plastics may never compete with glass for most photographic purposes. The manufacture of optical elements from these transparent resins is still somewhat restricted and the first commercial applications probably will be in providing heat-resistant condensers for photo enlargers, large-field upright-image view finders, and portrait lenses of large aperture and long focal length. At present it appears that plastic lenses enjoy little if any price saving over glass.

Movies in full natural colors from black and white film are achieved by a new optical system that eventually will be available for all movie cameras. Developed by



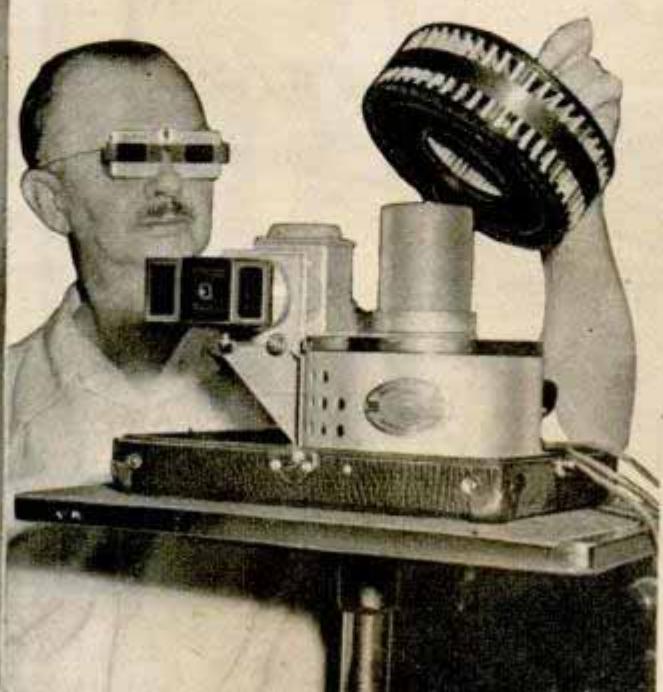
Motion picture camera (right) equipped with Thomas-color lens takes natural color pictures on black and white film. Projection lens (left) converts black and white images back into natural color when shown on a screen

Richard Thomas Enterprises, Inc., Hollywood, the system consists of a special lens assembly that is interchangeable with the ordinary lens used for black and white motion picture photography. The lens barrel is divided into quadrants, each of which has its own lens. Light that passes through one of these lenses goes to the view finder, while light that passes through each of the others travels through a special filter before being recorded as a separate frame on ordinary film. Each frame of film is thus divided into four parts, three of which record the same scene as seen through different filters.

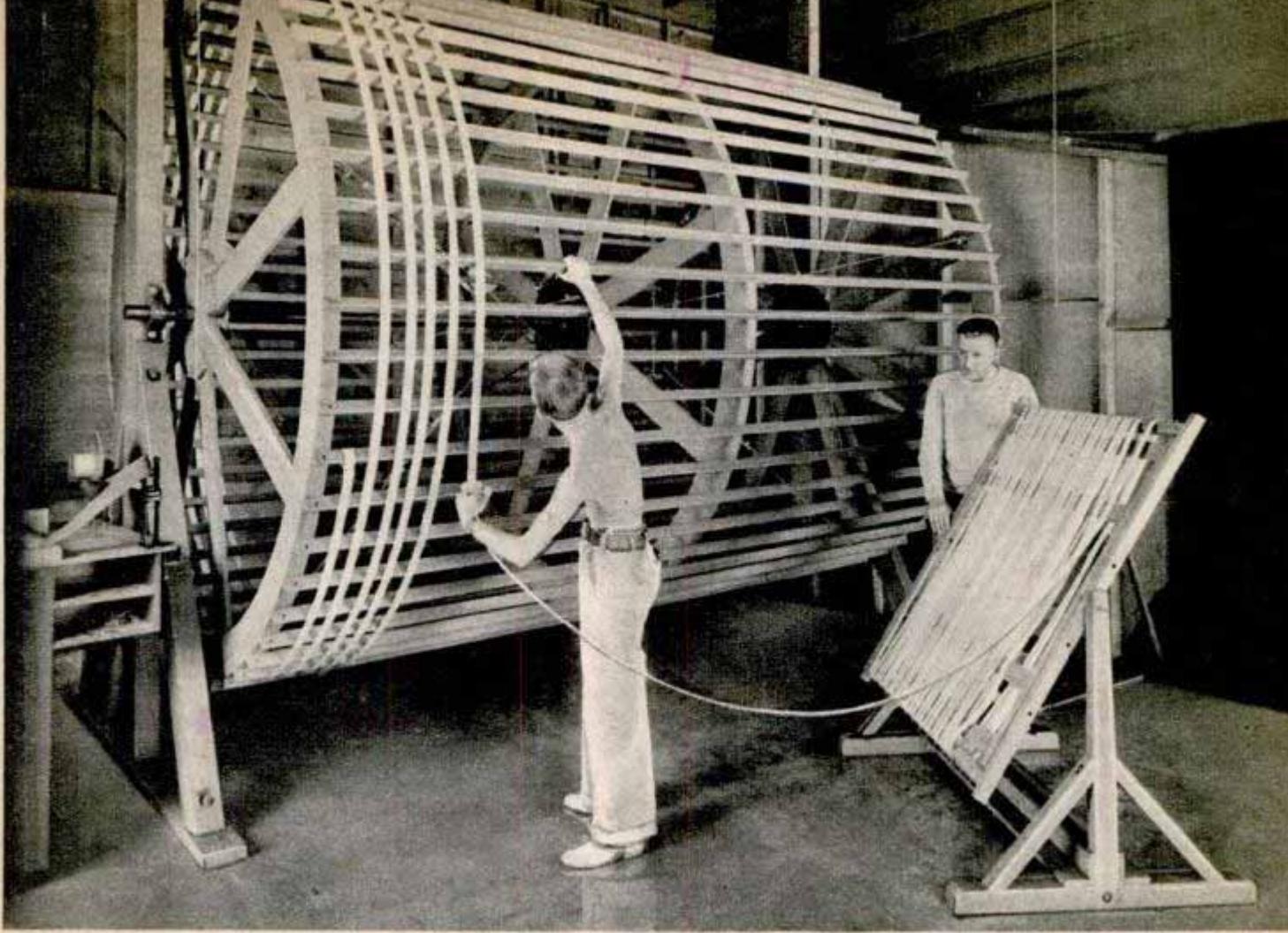
When a print from this negative is projected through a Thomas-color projection lens the three images again pass through their respective color filters, pick up the colors that were filtered out during exposure, and are superimposed on the screen as one picture in natural color. Lens parallax is adjustable for any length of projection. Special lighting is not required, speeds of up to 1/1000 second may be used, and processing is the same as for any other black and white film. The company at present is building commercial sizes of motion picture lenses and foresees the time when news reels in color will be standard.

Similar lens arrangements will be made for still cameras: a three-lens system for still pictures that are to be printed by the wash-off relief method, and a four-lens system for negatives from which color printing plates are to be made.

Coated lenses that transmit more light to the film and reduce flare and fog, making cleaner, sharper negatives, are standard on many post-war cameras. A coated lens has a layer of fluoride or some other compound only a few millionths of an inch thick on each surface. They must be cleaned with care.



"Selectorslide" projection apparatus shows color transparencies in three dimensions. Spectators wear polaroid spectacles



to avoid scratches. Present optical elements for cameras, enlargers and projectors can be coated at a cost of \$2.50 per surface and up.

A preview of the trend in cameras is provided by the combat model of the 4x5 Graphic used during the war. This camera has a sturdy permanent hood that protects the extended bellows. It has both front and back shutters and the shutters are interlocked to insure that the one not in use remains open. It is equipped with a built-in flash synchronizer and the batteries that operate the flash are carried inside the body of the camera. The camera is much more dustproof and weatherproof than prewar cameras.

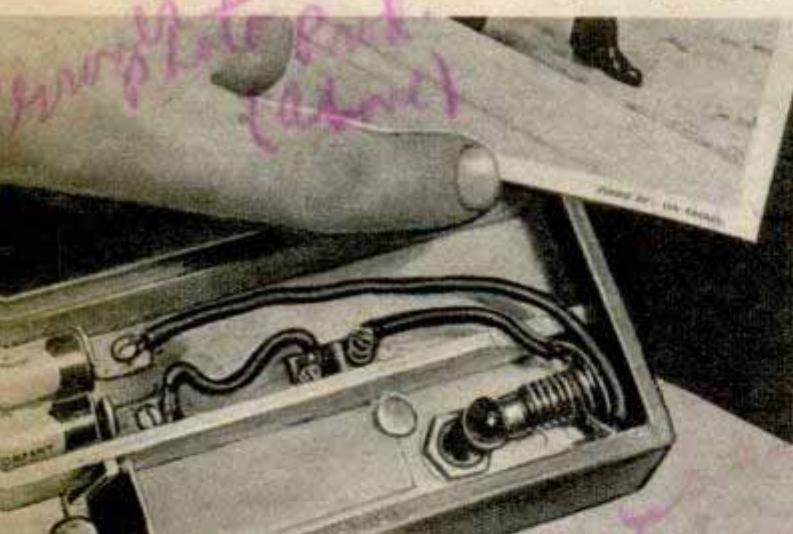
One of the most amazing of all photographic effects is the projection of natural color transparencies in three dimensions. Stereoscopic attachments that are placed over the lens of a miniature camera are available for shooting three-dimensional pictures, which then are observed by means of a stereoscopic viewer. A new "Selectorslide" projector incorporates this feature together with polaroid filters and achieves three-dimensional effects on a translucent projection screen. The projector has a rotary magazine which holds 48 color transparencies. Close-up pictures projected from this apparatus often have the startling appearance of reaching out

Drying black and white film on which Thomas-color natural color pictures have been photographed. Below, new rotary film and paper processing tank for color shots

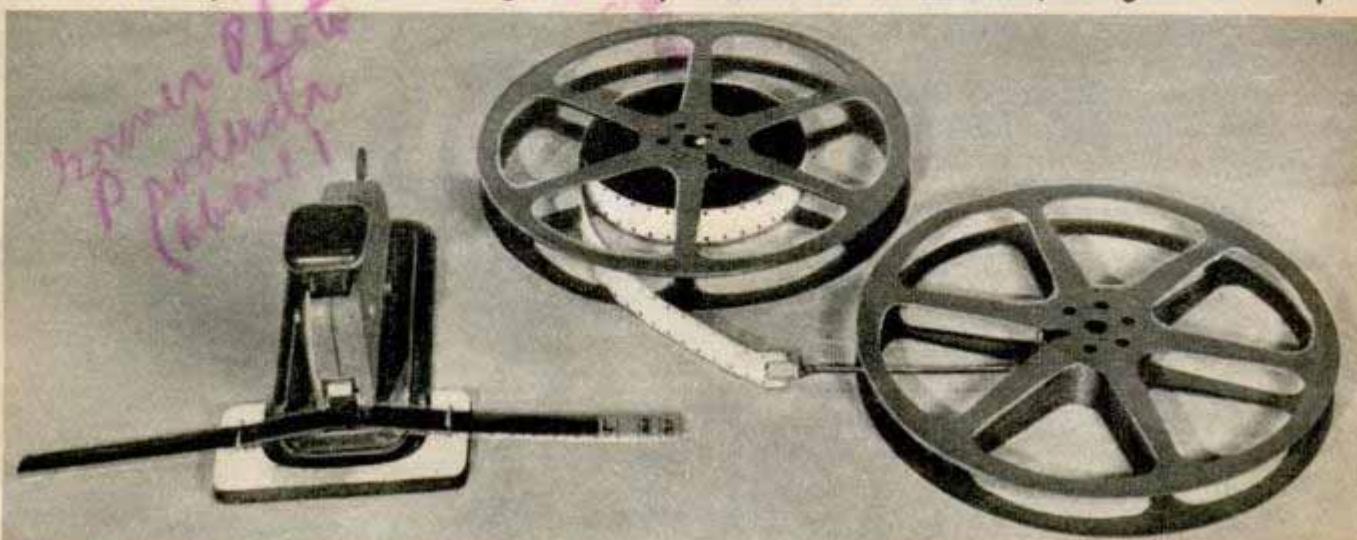




Motion picture camera powered by a battery-driven motor with chain and sprocket wheel. Below, photo printer places wording on the margin of photographs



With this film splicer and flexible "tongue" it's easy to thread film on movie reel, saving time and tempers



toward you. Polaroid goggles are worn in viewing the screen.

Another device which creates three-dimensional effects is an "optical balance" lens invented by Stephen E. Garutso Hollywood. It is reported to give great depth of field from 40 inches to infinity. The lens is so small that it fits into the objective barrel of any photographic camera making stills or motion pictures.

Threading movie film on a reel has always been a nuisance and this job is made easier by use of a flexible strip of metal, one end of which is attached permanently to the hub of the reel. The free end of this "tongue" projects out beyond the reel and contains a clip to which the film is easily secured. The flexible metal strip and the film itself then are wound up on the reel in the usual manner.

A film splicer for movie film works on the principle of a stapling device and "welds" the film ends together with transparent tape that is coated with a special adhesive.

For amateurs who wish to process their own home movie film a simplified five-compartment developing tank has been perfected in which from 50 to 1600 feet of 16-mm. negative film may be processed at one time. Film leader is first wound up and down over a series of power-driven rollers, then the compartmented processing tank is raised up into place, submerging the length of leader material. One end of the leader is attached to the end of the exposed reel of film. The tank is light-trapped so that lights may be turned on in the room after the processing has started. The leader and film travel progressively through a developing solution, a short stop, hypo and two wash tanks, after which the film moves through a drying compartment and is finally wound up on a reel, completely processed. The machine is driven by a $\frac{1}{20}$ -horsepower motor, the speed of which can be adjusted to the particular developing solution used.

(Continued to page 154)



Hobbyist Makes Tiny Horses of Balsa Wood and Calfskin

With the lightweight balsa wood from which boys make model airplanes, an Oregon hobbyist carves miniature horses. The wood is covered with plastic wood to get the proper curves and smoothness. When the form has hardened it is covered with calfskin for a surprisingly realistic effect. Mane and tail are added to conform with the coloring and breed of horse. Two favorite subjects are a mare and her young colt. Saddles, bridles, packs and blankets all are handmade. The horses are made by Fannie Branson of Agate Beach, Oregon, who has spent most of her life on a ranch. She took up the hobby several years ago after being crippled by a fall from a horse.

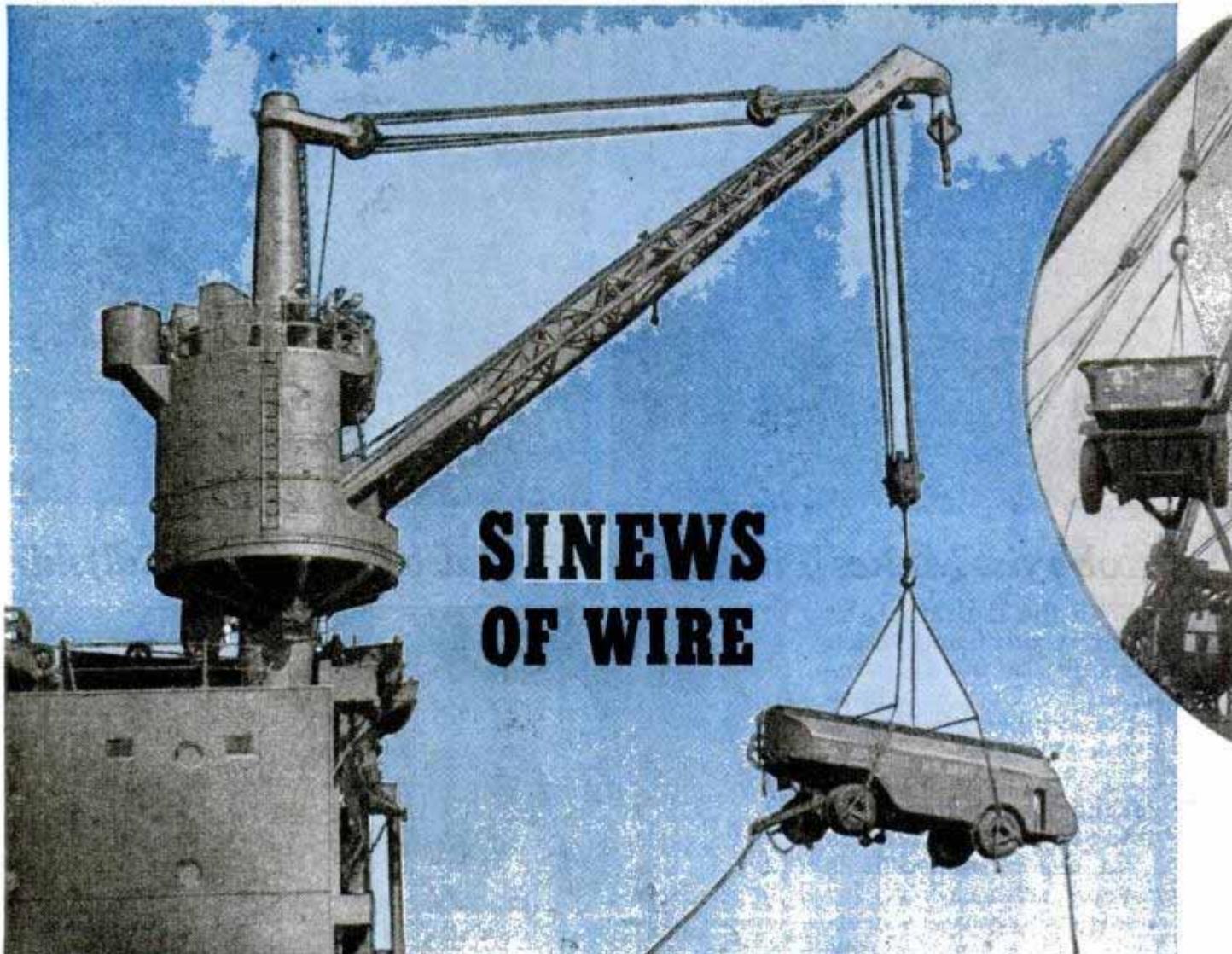
After applying plastic wood and calfskin to a balsa frame, Mrs. Branson adds saddle and other accoutrements. At right, she looks over part of her "herd"



Three Guns Behind Plane Propeller Fired by Electric Synchronizer

Firing of three .50-caliber aircraft machine guns through a three-bladed propeller rotating at 800-1500 r.p.m. is provided by an electric gun synchronizer developed by the Fairchild Camera & Instrument Corporation. The system consists of a timer

unit, control box and three motors, one for each gun. The control box transmits firing impulses to the motors. The trigger-motor armature, weighing only 2½ ounces, exerts a 55-pound punch and takes a 110-pound recoil 72 times a second.



U. S. Navy photo

Derrick equipped with strong steel cable lowers a tank trailer to the deck of the USS Curtiss at Pearl Harbor

SINEWS OF WIRE

FOR two hours guns on naval ships poured

shells into space at unseen targets, and as the night mist broke into cold rain anxious men on these ships looked at their wrist watches.

H-hour! Landing barges dropped down at ends of thin steel threads and pulled away from the ships. They hit the beach and the ramps dropped down. Tanks, trucks and jeeps with motors roaring streamed out. The beach was not all sand—some of it was soft and muddy. Coming off the ramp a jeep sank sideways and both front and rear wheels on one side quickly disappeared into the soft ooze. The driver and two helmeted figures abandoned the vehicle, and struck out for more solid ground. Behind the jeep, two more jeeps with trailers were helpless—and useless—since the way was blocked.

But the beachmasters—the special engineer ship-to-shore troops—were ready for just such delays. A bulldozer tractor was backed up close to the edge of the muddy spot, a hook at the end of a wire cable was extended and fastened to the bumper of the jeep. The tractor treads dug into the

By Staff Sgt. John L. Kent

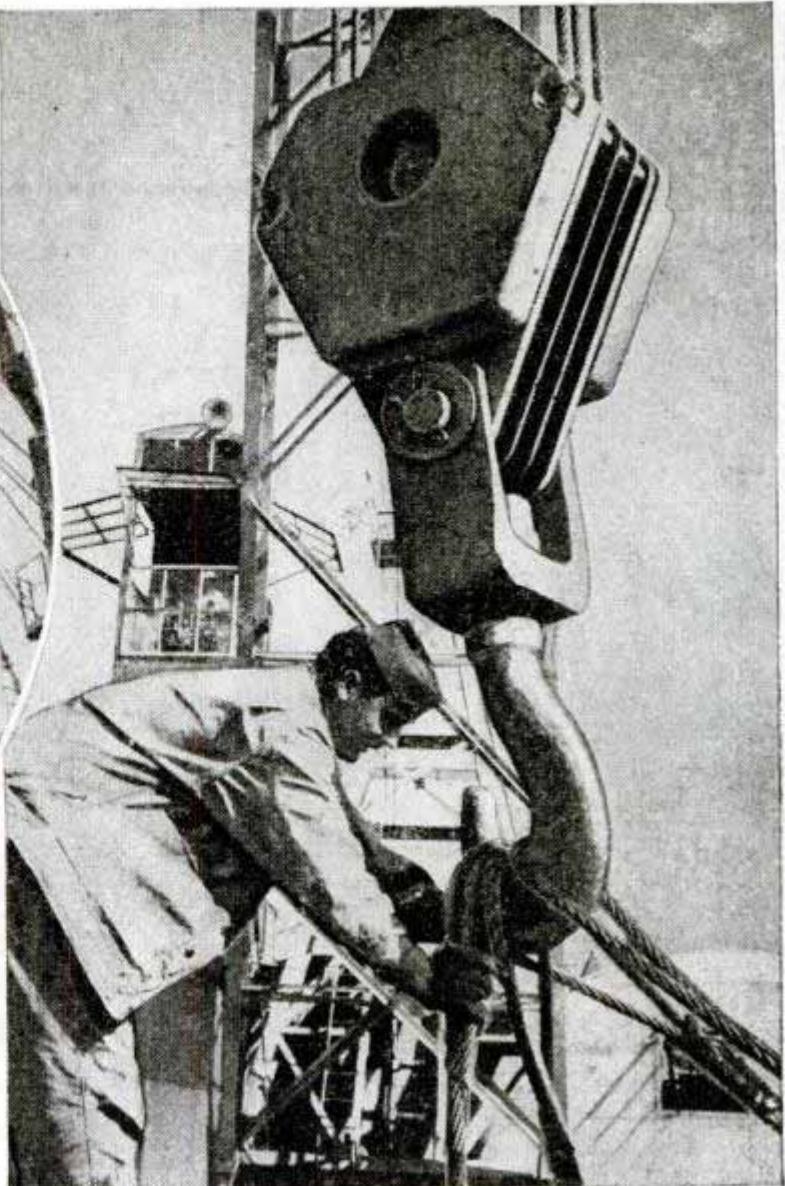
sand and the jeep dragged a furrow in the muddy sand as it was pulled out. This thin, many-plied steel strand saved the day for the three jeeps and their crews.

If a friend of yours who works in a wire rope factory came to you and said: "Bill, the reason we won the war is because of wire rope," you would think him prejudiced and attaching undue importance to his job. Yet here's what he could tell you that wire rope did in the war:

Every Allied ship was loaded by derricks, ship cranes and hoists, all using wire rope. The "on-deck" cargo on the thousands of ships used during the invasion of every Pacific island was lashed to the deck hold-down rings with wire rope. On D-day, wire rope tethered the myriads of barrage balloons which swayed above the ships anchored off the Normandy coastline and prevented dive bombers from scoring direct hits. Boxes of ammunition and supplies, trucks and tanks and the hundreds of small landing craft were lifted from the decks and holds of the invasion flotilla with wire rope hoists. The ammunition used by the guns of the naval vessels during the



↑ Supported by steel cable lowered from a derrick, a tank and a jeep are loaded aboard a ship bound for overseas

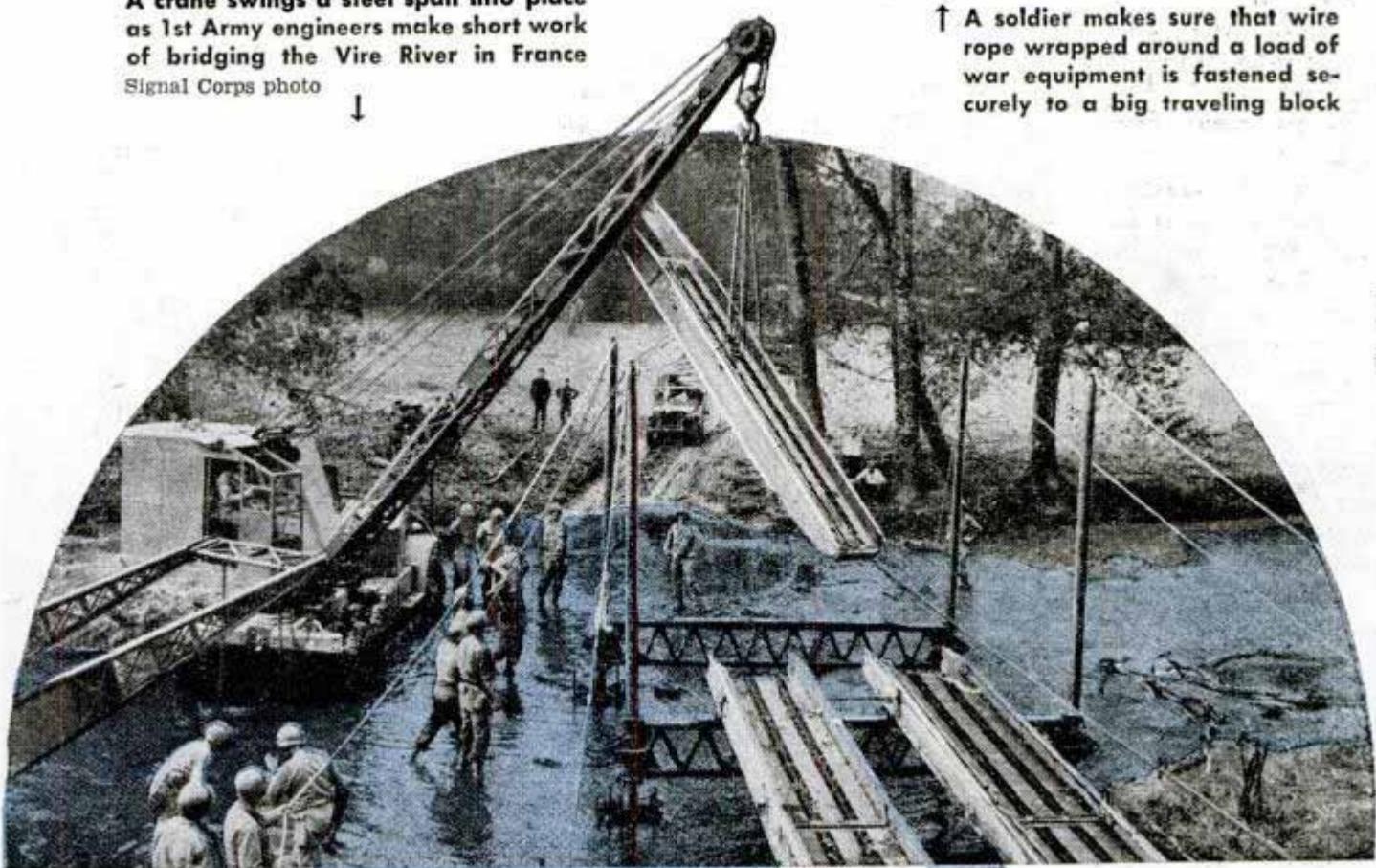


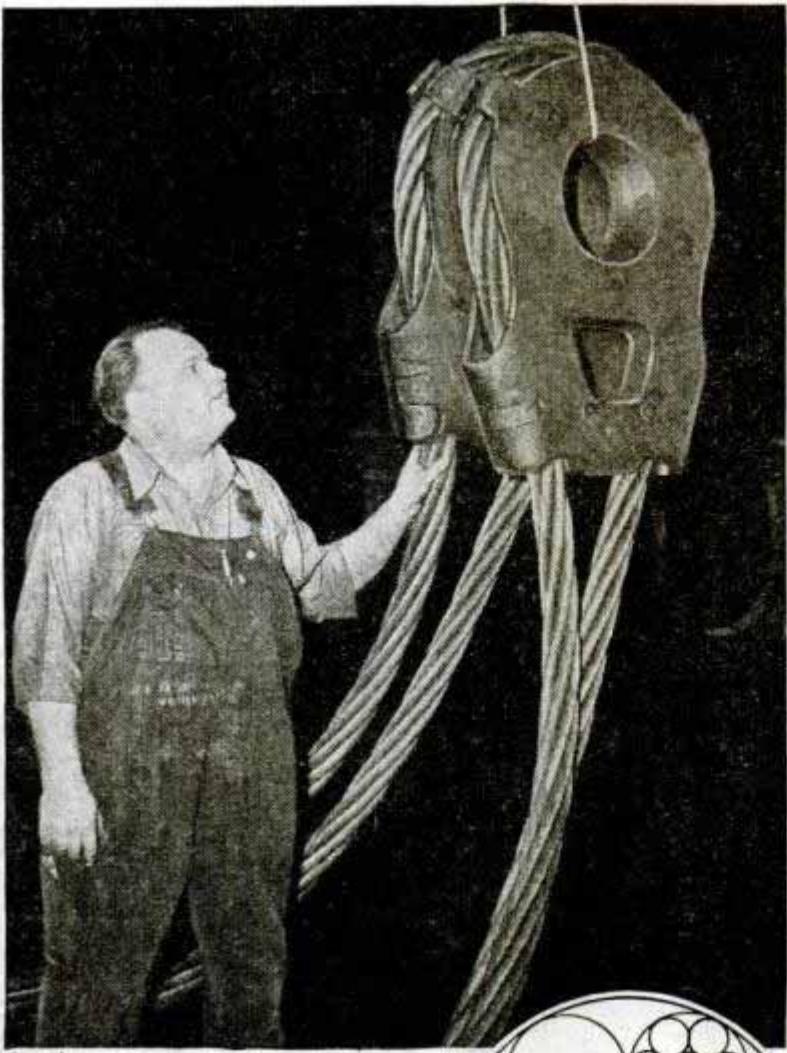
A crane swings a steel span into place as 1st Army engineers make short work of bridging the Vire River in France

Signal Corps photo

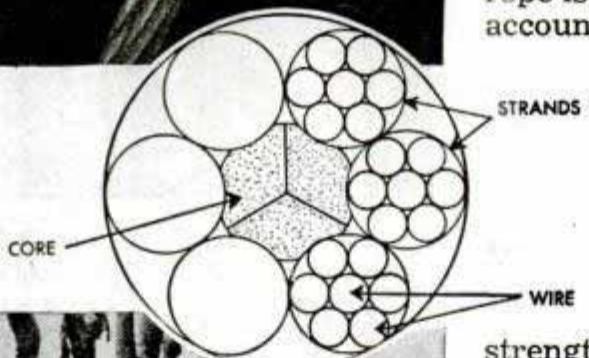
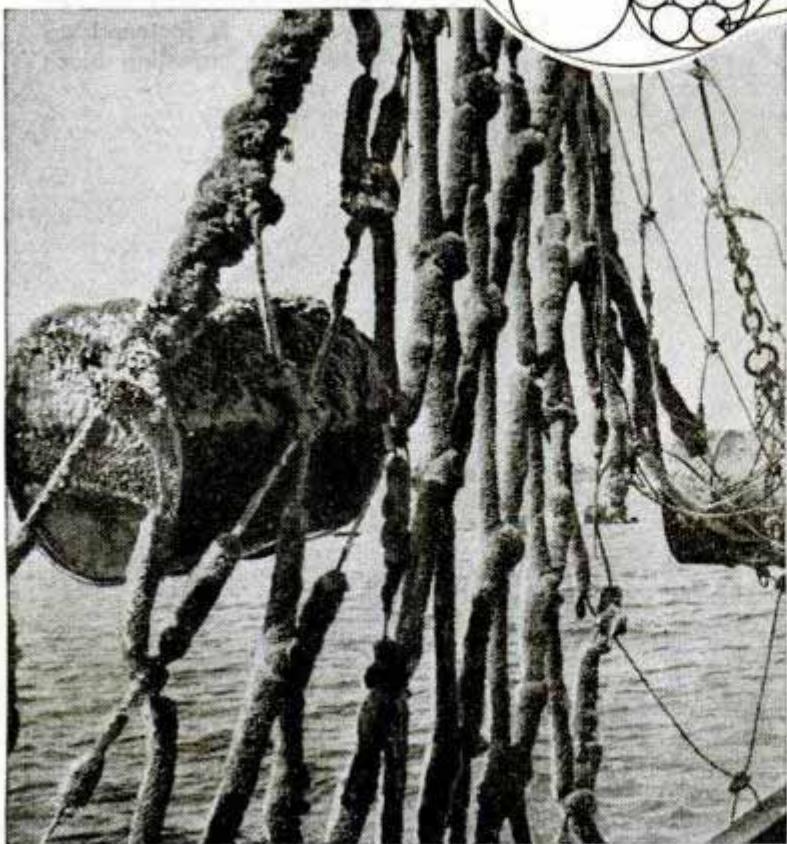


↑ A soldier makes sure that wire rope wrapped around a load of war equipment is fastened securely to a big traveling block





Courtesy
John A. Roebling's Sons Co.
Wire rope sling to handle
big Navy guns. Right,
cross section of hemp
center wire rope. Below,
fouled sub net of wire
is hoisted for cleaning



preinvasion barrage was hoisted to the gun turrets by wire rope or wire drawn elevators.

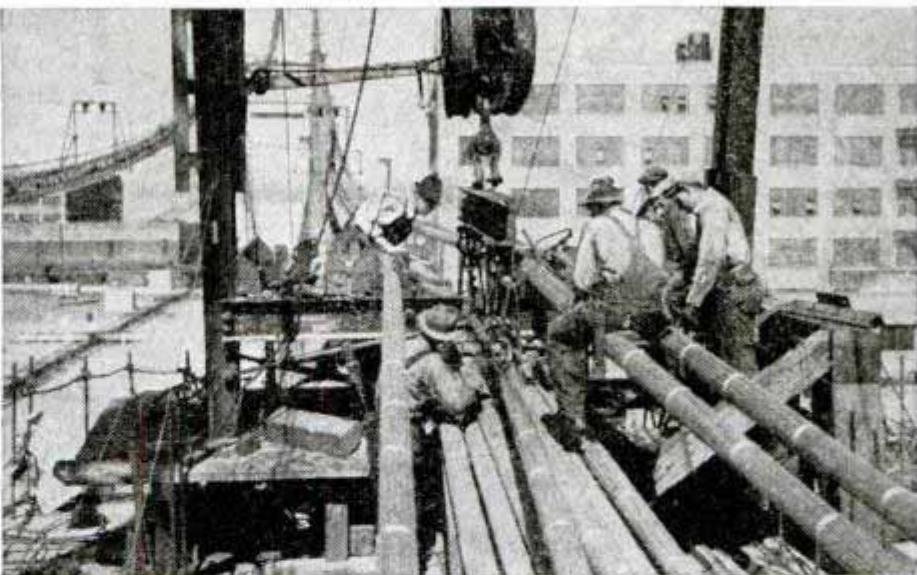
The ship's rigging, the masts holding the booms of the derricks, and winches of all kinds use steel cable—over two miles of it for a typical cargo ship. A combat cargo ship loaded for invasion takes almost $6\frac{1}{2}$ miles of steel wire of all sizes from $\frac{1}{4}$ inch to $2\frac{1}{2}$ inches. There are over a hundred different uses of wire rope directly involved in operation of ships, military vehicles, machines and devices. At sea, all naval ships use wire rope, from the speedy PT boat whose controls are cable-operated to the giant aircraft carrier whose arrester ropes stop planes on the flight deck. Military aviation depends on wire rope, for every plane, be it fighter, bomber or cargo, has cable-operated controls. The Air Forces use wire rope in torpedo lifts and bomb hoists, bomb release controls, remote controls for guns and seaplane hoists.

Experience has shown that wire rope is extremely adaptable, which accounts for its wide use. It is more

than three times as strong as the best manila rope of the same diameter and, of course, more wear resistant. In a strength lifting comparison, a $\frac{3}{4}$ -inch wire rope is equal to a 1-inch chain or a 3-inch manila rope. Wire rope gets its strength from the combination of small wires of which it is made. Steel cable is built up. A certain number of wires are twisted together to form strands. These strands in turn are twisted together around a common center—the core, which is usually manila rope or hemp, or sometimes a single steel wire. These strands form the completed wire rope. If a flexible wire rope is required, such as one that moves over many small pulleys, the center is made of hemp, as this is more flexible than steel wire, and there also will be a great number of thin wires in each of the strands. The strands also will be more numerous. While flexibility of wire rope is a good thing, making the wire smaller to get this flexibility makes it wear down sooner as there is greater area in contact with pulleys and cable drums. A compromise usually is decided on.

The 6 x 19 and 6 x 7 are two common wire rope constructions. The 6 x 19 is used on cranes and derricks and construction equipment such as power shovels and draglines. Its designation identifies it as having six strands of 19 wires each. The 6 x 7 also has six strands, but each strand has only seven wires, which makes this wire less flexible. However, it lasts longer as there is less contact area for abrasion over wheels and pulleys. The 6 x 7 is used on long cableways and hoists where there are no small pulleys.

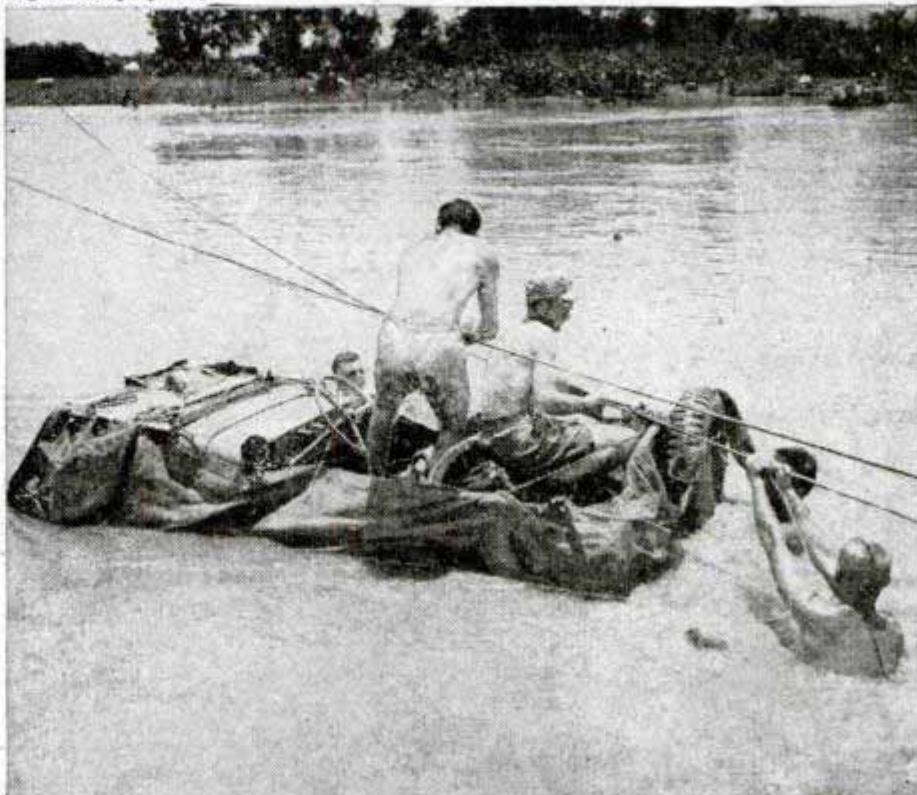
Because wire rope must be cut and various hooks and attachment devices fitted, research has developed a "preformed" wire rope which makes simple the time consuming and often dangerous task of cutting and binding wire cable. Ordinary wire rope has to be "seized" at the end when cut from the reel, as it tends to spread, the wires being more or less springlike and under constant tension to break away from the center core. In preformed wire rope, the internal stress has been eliminated and the rope is "at rest." Preforming makes the individual wires and strands lie down to fit the rope. When individual wires are pulled away from a preformed cable, they hold the wavy shape into which they have been preset during manufacture. Field experience has proved that one of the greatest advantages of preformed wire, next to being easy to cut, is the increased bending-life property of the cable. The results of preforming are amazing. A gravel plant using 500 feet of 7 x 19, 1½-inch diameter preformed wire rope on its carrier line excavated over 50,000 cubic yards of

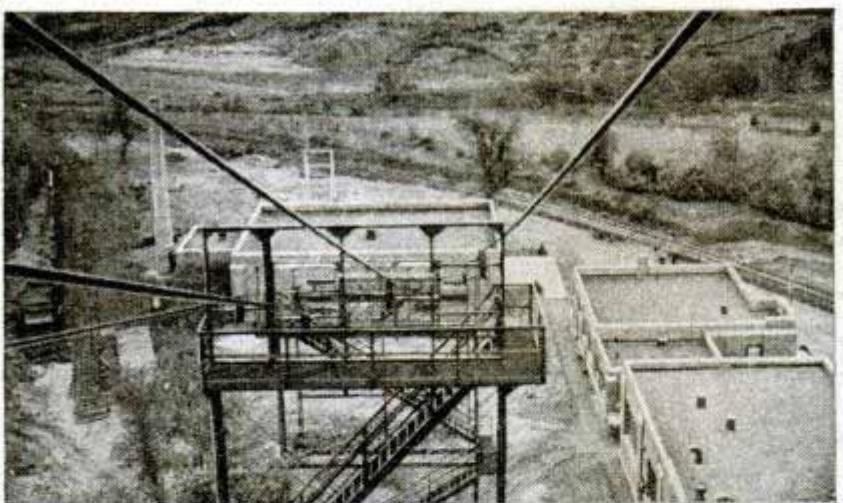


Workmen set a strand in position in main cable while building San Francisco-Oakland Bay bridge. Below, the completed bridge viewed from the center line. The main cables of the bridge are 29 inches in diameter



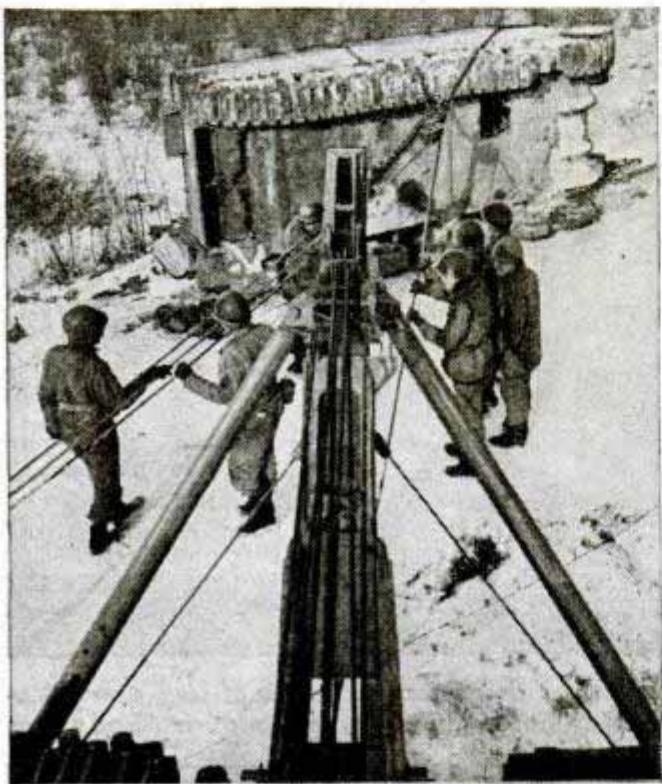
Below, using wire rope cables as guides, soldiers float jeep across Mo-gaung River on their way to Kamaing, Burma, to join other Allied forces
Signal Corps photo





Inland Steel Co. photo

Up these sturdy cables ride "skips" filled with ore on its way to be dumped into railroad cars or trucks



Ordnance men equipped with derrick and wire rope go to rescue of medium tank disabled by land mine. Below, steel cables lower boom to unload crushed rock

Wickwire Spencer Steel Co. photo



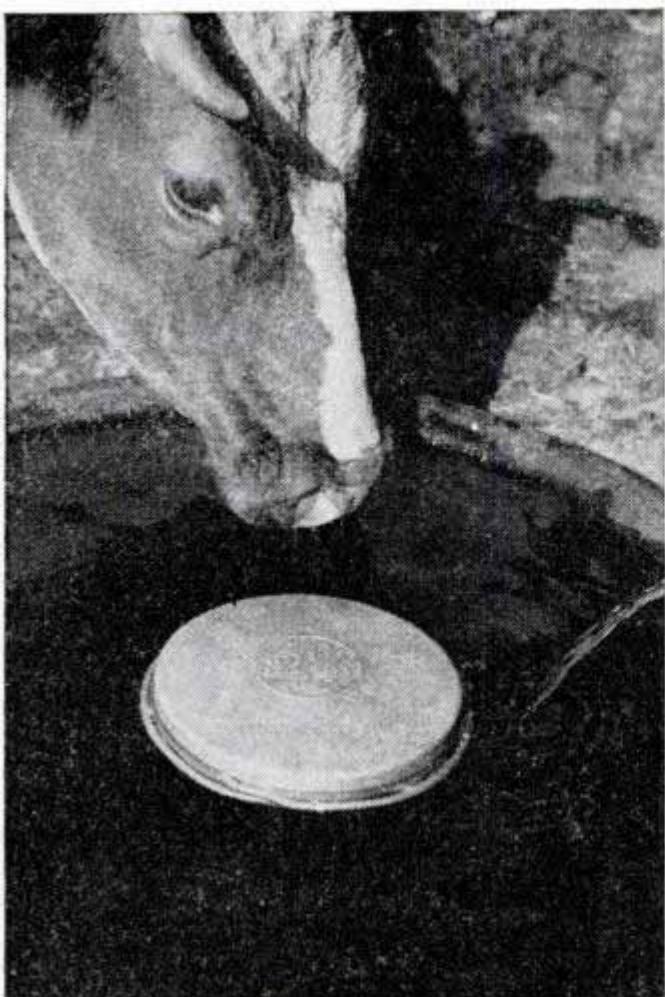
gravel, while with ordinary wire rope the output was only seven to eight thousand cubic yards before the cable had to be replaced.

Because wire rope does not part instantly, like a chain, for instance, but gives warning of failure far enough in advance, it is ideal for hoisting wires and sling cables.

Wire rope, like a machine, is a built-up device and requires attention. Also, it must be oiled. Oiling wire rope prolongs wear and prevents rusting. Periodic examination usually reveals when a wire rope no longer is safe. Sometimes, however, ropes fail without any apparent cause. Some months ago 16 miners were killed in Canada because a wire cable failed. The cable broke near the hoist drum while the cage carrying the miners was at the 1000-foot level of a 2500-foot shaft. Undetected internal corrosion of rope strands caused the rope failure. The external portion of the rope was well lubricated and did not indicate that internal corrosion existed. When the rope was tested at the Wire Rope Laboratory of the Ontario Bureau of Mines, it revealed a 61 percent reduction in ultimate strength at the point of failure.

Many new uses constantly are being found for wire rope. It now is being used instead of cord or fabric in making of transmission belts. The steel cables are encased in an envelope of non-load-carrying fabric and molded in the rubber of the belt. The cables consist of a specially twisted, finely stranded, high tensile wire. Half the cables in a belt are twisted to the left and half to the right to insure a neutralized, true-running belt. The belts are described as being virtually unbreakable, because the cables are imbedded in rubber and encased in a fabric envelope and for that reason receive no external, strength reducing wear.

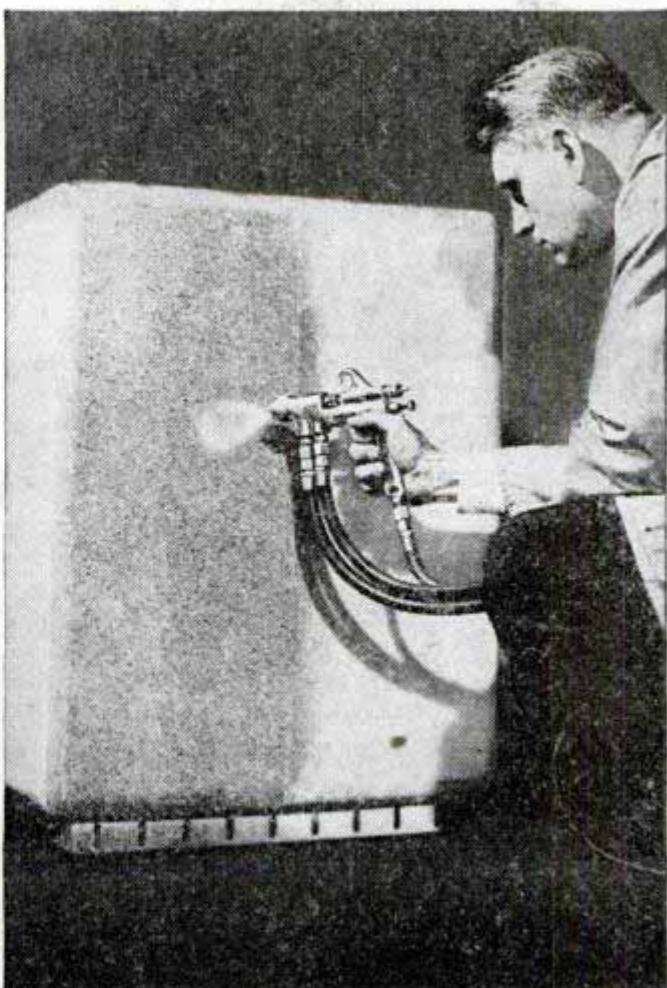
Almost every industry in the U. S. will benefit, either directly or indirectly, from war-tested improvements which have resulted in stronger, safer and more versatile wire rope. There are no more H-hours with landing barges to be lowered over the sides of ships; but the greatest peacetime cargoes in history are awaiting safe transport; the longest and strongest bridges are yet to be built, and the largest air liner with cable-operated controls has yet to span an ocean.



De-icer equipped with a heating element prevents ice from forming in water tanks even at 22 degrees below zero. Below, compressed "fresh air" is supplied to firemen from small tanks carried on their backs



Hand-operated motor tractor simplifies gardening. Below, two-color spray gun has an extra fluid inlet to supply an additional color of paint sprayed through the same nozzle. "Spatter" finishes also are possible



Irrigation Revives Fur Trapping

Fur trapping is staging a comeback in Manitoba, Canada, after nearly dying out when droughts dried up most of the game-producing marshlands. In one month 1600 trappers bagged 445,000 muskrats whose pelts netted approximately \$900,000.

The revival of the fur trapping industry is the story of government engineers bringing irrigation to 134,000 acres of arid land in Manitoba. A network of dams, ditches, dikes and canals impounded and distributed flood waters from adjoining rivers. At first no trapping was permitted so that muskrats could have a chance to build houses. In one year the muskrat houses in the huge preserve grew from 60 to 800, in three years to 32,800 housing an estimated 165,000 muskrats.

After five years 400 men were permitted to trap the area during a three-week period, with a limit of 300 muskrats for each trapper. The muskrats they caught brought \$162,000 at auction in Winnipeg. After the Manitoba government took a percentage to pay for part of the irrigation costs, each trapper was given \$100, plus \$20 a month for 10 months.

Other sections of Canada are now being rehabilitated. Manitoba is applying strict conservation rules to protect fur trapping. Trappers are registered and permitted to trap only in certain areas, and trapping that kills off breeding stock is discouraged.

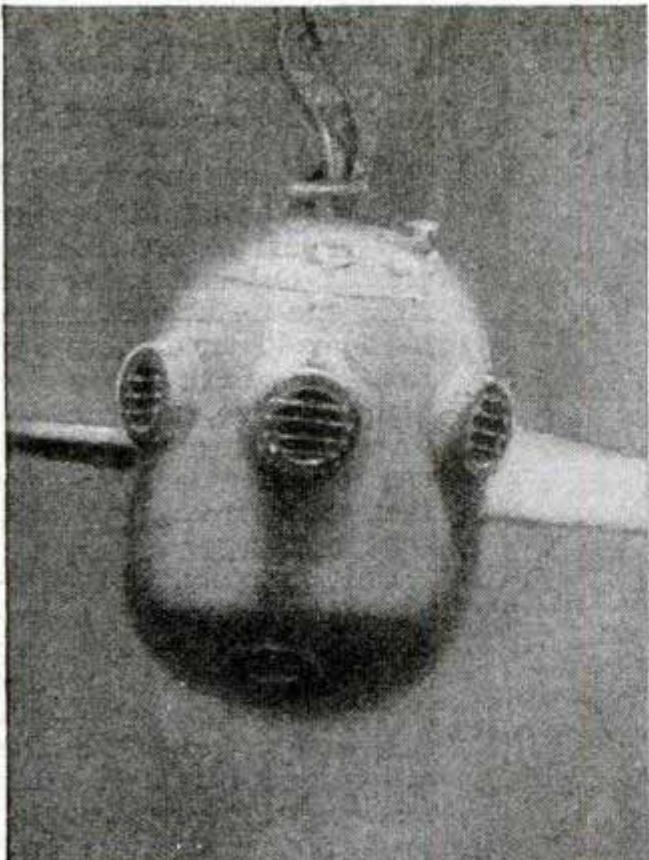


Muskrat skins are placed on stretchers to dry. Below, a trapper carefully sets his trap in a muskrat house in Manitoba



Fur trappers travel to Canadian marshland in tractor-drawn sled





Snapshots on the Ocean Floor

A pressureproof, watertight camera is being built for taking pictures 300 feet under water to provide "blueprints" for deep-sea divers searching for valuable cargo in sunken vessels.

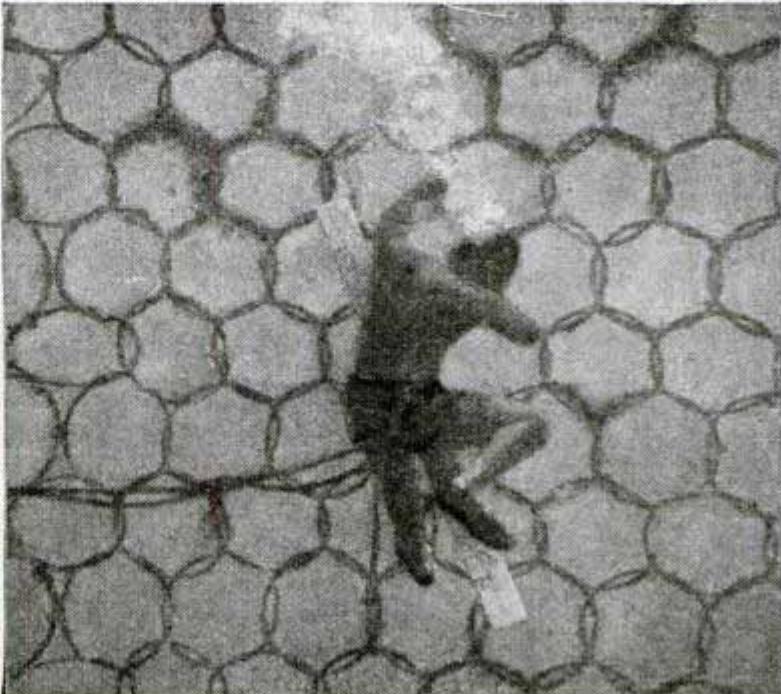
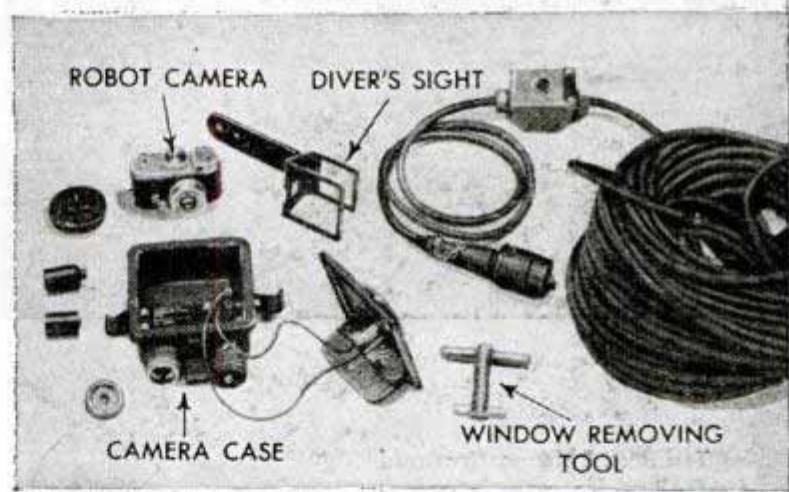
The camera, details of which still are secret, was designed specifically for Navy mine disposal work. It also was used to study damage to sunken warships and to inspect antitorpedo and anti-submarine nets.

Developed by Photo Utilities, Inc., and Graflex, Inc., the camera uses standard film, filters and flash bulbs and is operated from the surface by electric controls or carried under water by a diver.

The automatic motor and film transport mechanism of the K-25 aircraft camera is utilized in the underwater model, plus the 90-millimeter Graflex optar lens in a synchronized shutter designed for press cameras. Other standard equipment includes an aluminum pressure case with pressure type controls for lens, diaphragm and shutter. Waterproof socket reflectors developed by the Mines Equipment Company make it possible to change bulbs under water.

Assembly for underwater photography, above right, provides shots such as the one below of diver examining antitorpedo net

Underwater camera catches Navy mine observer in towed subsurface glider and, right, diver attaching firing cable to mine



NAVIGATION FOR THE SKY TOURIST

By S. G. Cooper



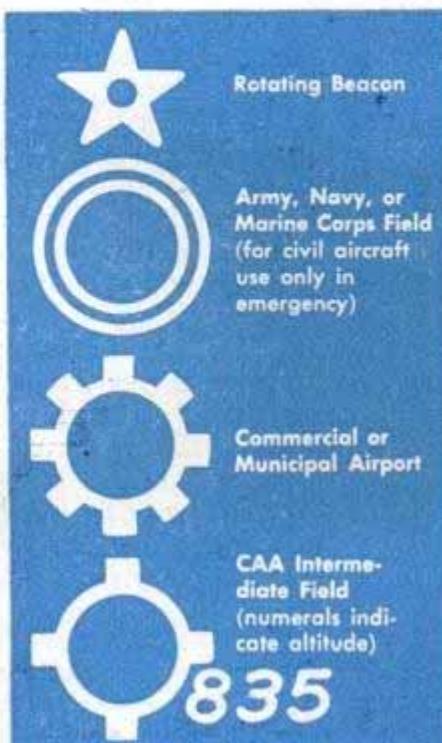
Ted Sills, Chicago flyer and CAP major, unreels antenna (shown below) so he can use his radio as a navigational aid to tune in on "sky highways" when he is flying to other cities

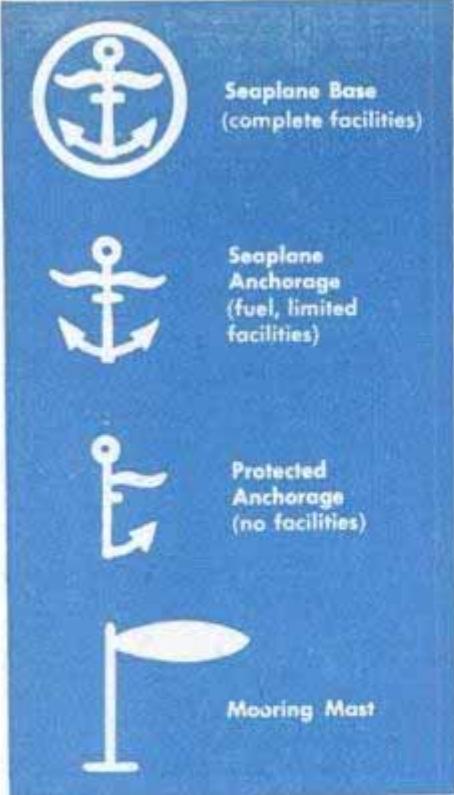


THERE are many land highways, and the car driver has no trouble in picking out and using the right one to take him from his home to any city, near or far. There are many sky highways, too, and the airlines tune in on them and use them regularly to take their planes from city to city, safely and surely.

Unfortunately, the average private plane has no radio to tune in on them, nor do the radio ranges always go where he wants to go. It has been suggested that the country be dotted with markers visible from the air to help the pleasure flyer travel about easily, but if you intend to fly your own plane you had better learn the art of pilot navigation. You'll get more fun out of flying and you'll be much safer.

Pilot navigation is the navigation of an airplane by the man who is flying it. Almost always, it is contact flying, within sight of the ground. The pilot of a Superfortress doesn't have to worry about navigation; he has an expertly trained navigator





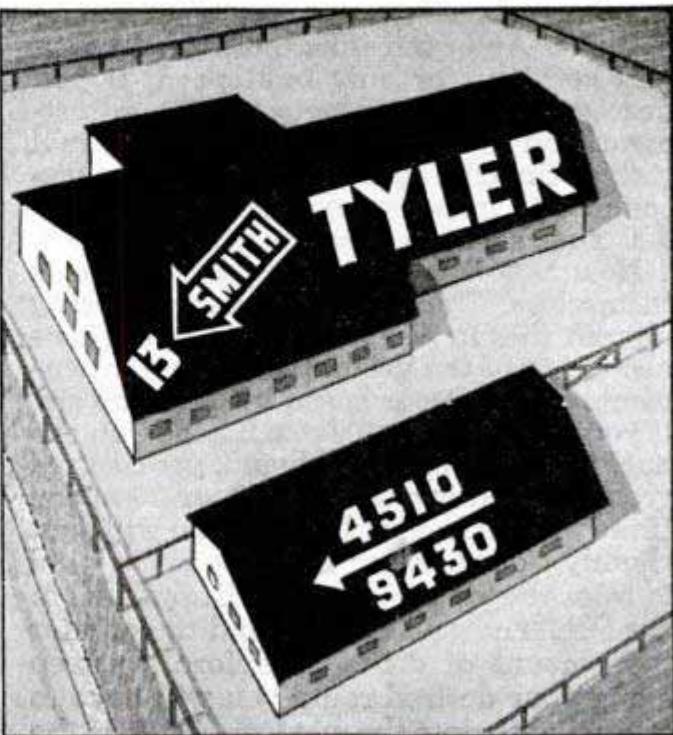
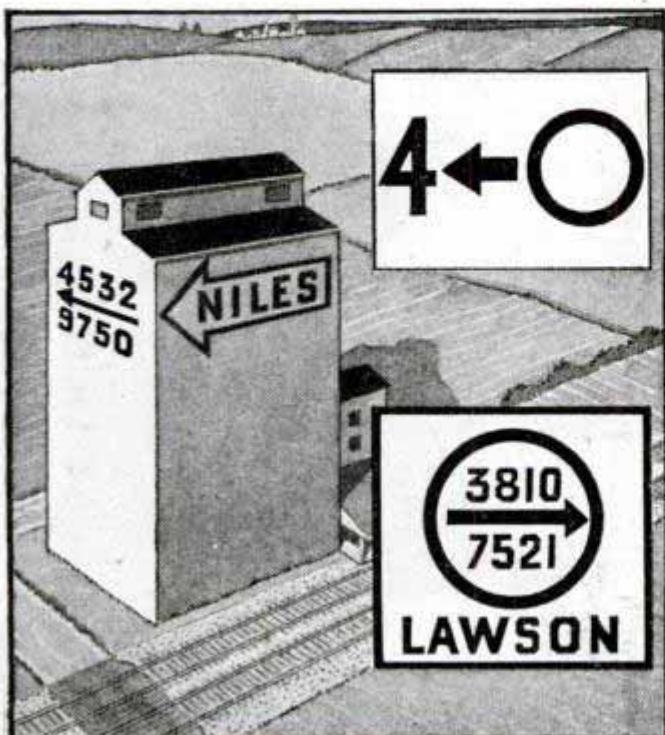
Landmark symbols (left) help in following air map. At right, pilot figures navigation problem with computer

who does the job for him, using all the tools that modern science can invent and the government can buy. The private pilot, on the other hand, is doing two jobs at once. He can't draw on a chart, because he has to fly the plane at the same time. He hasn't many instruments, because he can't afford to buy them, and wouldn't have the skill to use them if he did have the money. Under these circumstances, pilot navigation must be a simple affair—and it is, if it is learned correctly and used the same way.

The first requirement is to fly accurately,

and that isn't as easy as it sounds. Big aircraft have automatic pilots and gyroscopic instruments for the job, both of which are beyond the means of most private pilots. Remember that when you drive a car you can turn only to left or right, and even then if you aren't very experienced the car may wander all over the highway; in a plane you can go up or down as well. The magnetic compass generally used to keep an airplane headed straight in one direction is very sensitive to turns and changes in speed—and each time you gain

Under direction of CAA, 100,000 air markers are being installed throughout the nation to guide private planes



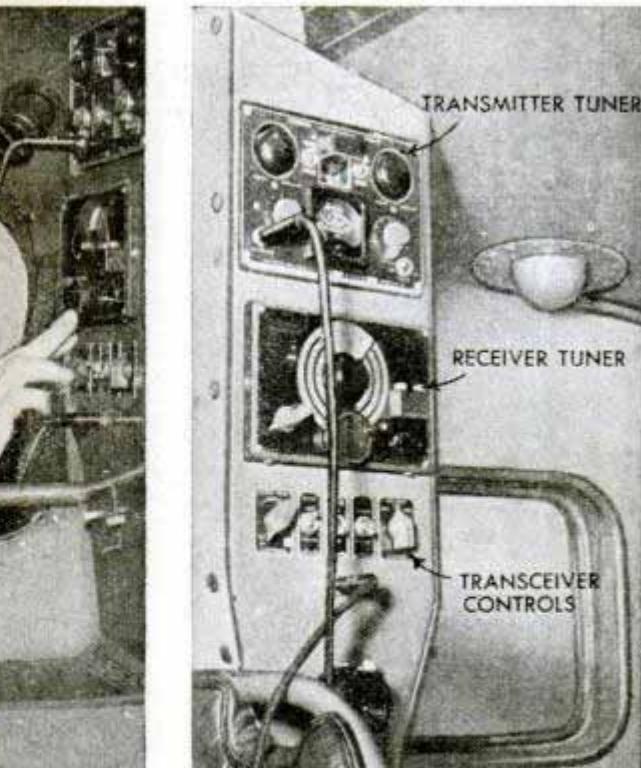


To get his bearings a flyer in a Grumman Widgeon tunes in his Lear radio. Right, closeup of the equipment

or lose a few feet of altitude your speed changes, just as it does when you go up or down a hill in an automobile without changing the pressure of your foot on the gas pedal.

Modern planes are equipped with little movable surfaces called trim tabs that can be adjusted to make the plane fly straight and level. In most light planes only the elevator tab is controlled from the pilot's position; tabs on the rudder and ailerons are just thin pieces of metal which can be bent as desired, when on the ground. This puts you at the mercy of the airframe mechanic; if he makes a mistake you're going to have to maintain a steady and tiring pressure on the rudder bar and stick to fly straight. And even if he did a good job, it will be right for only one speed; if you decrease or increase velocity the adjustment won't work. So if you're wise you'll look at the trim tabs and save a lot of discomfort by insisting on a controllable rudder trim as well as elevator trim.

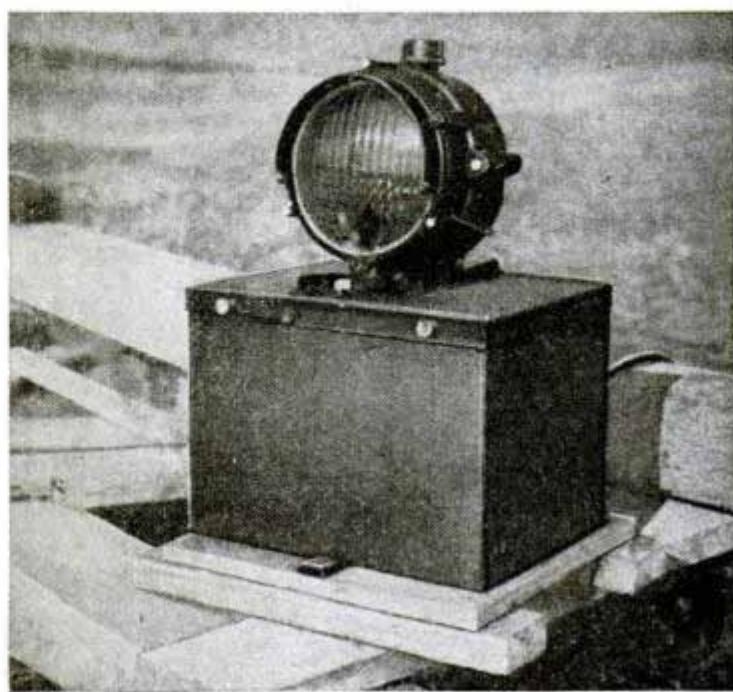
Now as to the pilot navigation methods themselves. You must remember that an aircraft flies in air, and has no actual connection with the ground. All your instruments show is your speed through the air; if your air speed is 100 m.p.h., and you are bucking a 20 m.p.h. headwind, your actual ground speed is only 100—20, or 80 m.p.h. If the wind is from either side you will drift slightly sideways; for example, if the wind is from the right side you will drift off to the left. The greater the wind the greater the amount of drift. Therefore, to keep along your desired route you will have to steer slightly into the wind, or a little to the

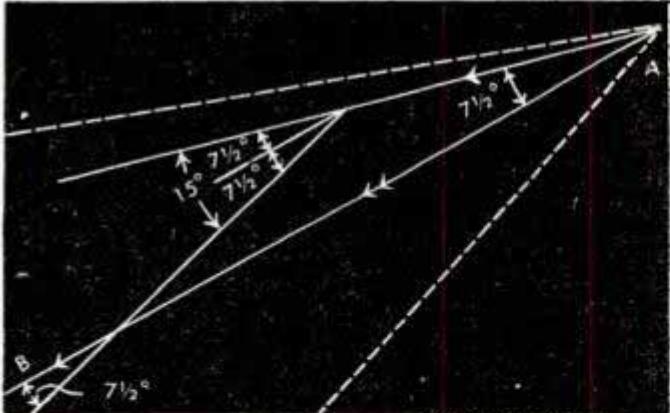


right of the direction which you want to go.

Let's assume that you are going to fly from point "A" to point "B." Before you get into the air, you should obtain the meteorological report, which tells you the weather situation and what the wind is likely to be. With this information, and your knowledge of the height and the air speed at which you intend to fly, you work out just what heading you will have to follow and what your ground speed will be. With one of the simple computers now on the market the average problem can be worked out in less than a minute.

Glide angle indicator developed by CAA throws out light showing correct vertical approach for landing



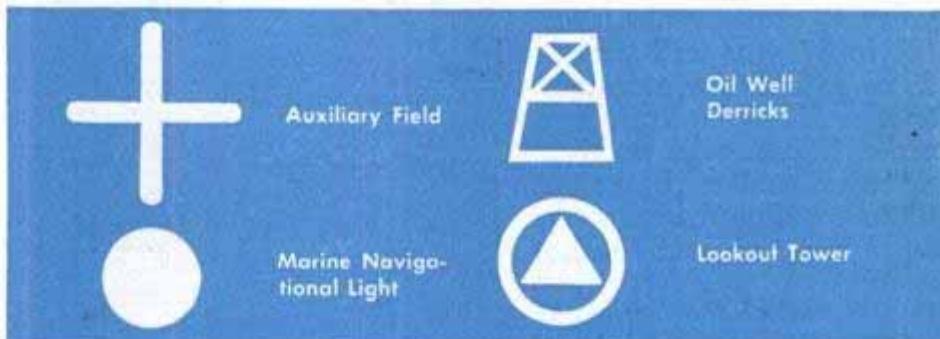
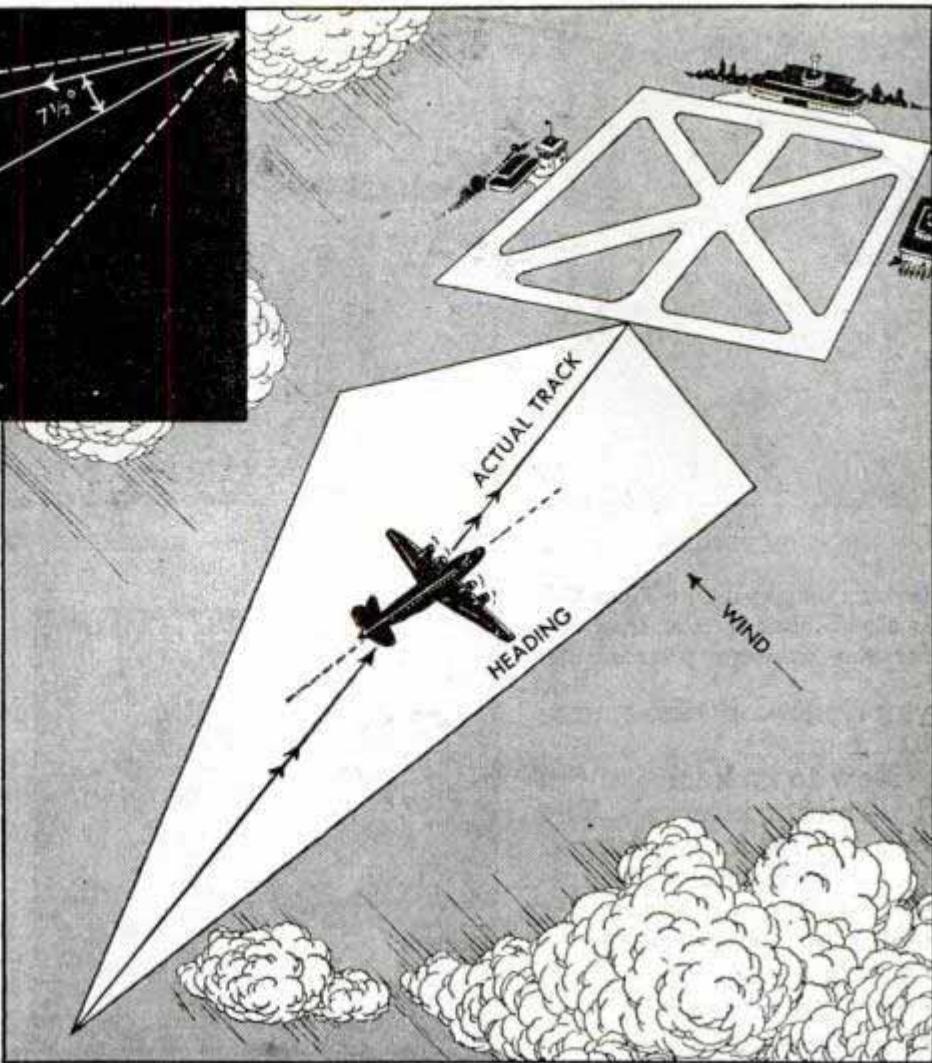


Off course by $7\frac{1}{2}$ degrees, pilot must make 15-degree correction to regain course, then turn $7\frac{1}{2}$ degrees again into true heading. (Angles are drawn twice size.) At right, plane is heading slightly into wind to correct for side drift

Now, if the forecast were absolutely correct, and you flew accurately the heading which you had figured out, you would arrive at point "B," and at the exact time you had calculated (this is your E.T.A., estimated time of arrival). Unfortunately, no weather report ever is that accurate, and so you must provide for being off course. There are several ways of doing this.

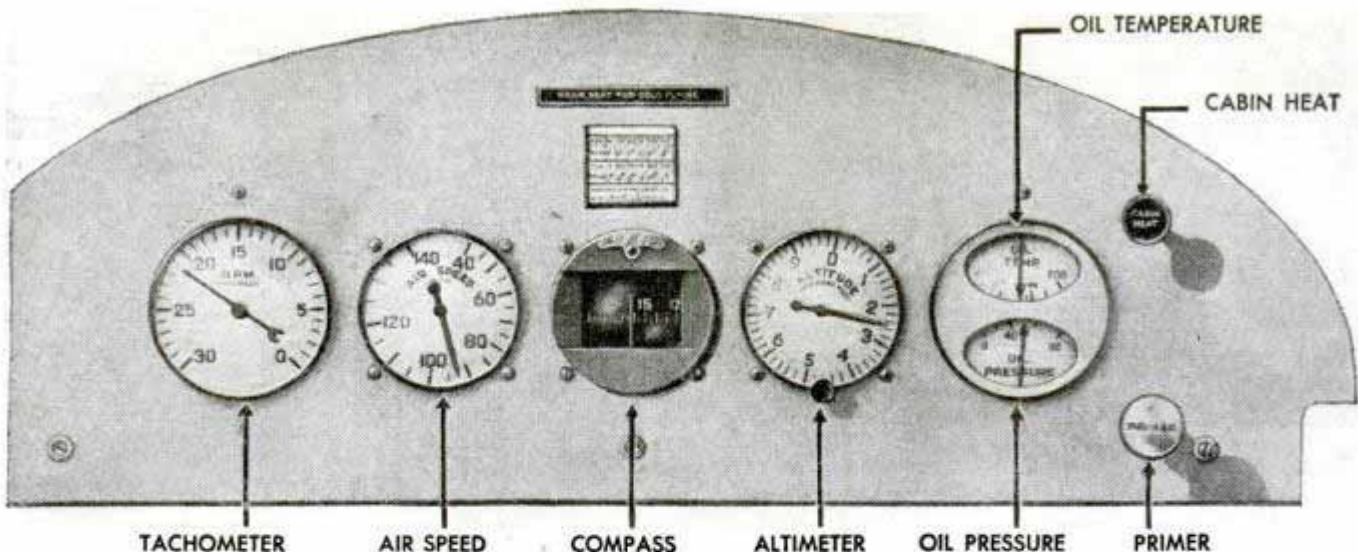
Draw a line on the map between "A" and "B" (your course) and from both "A" and "B" add the "10-degree lines"; that is, draw lines 10 degrees off the required course, and on both sides of it. Then draw in the "five-minute intervals," short lines at right angles to the course, spaced apart an amount equal to the distance that you calculated you would cover in five minutes.

Say that after 12 minutes of flying you manage to pinpoint yourself—that is, identify the position directly below you on the ground with a point on the map. This point, you find, is to the right of your proposed course, about three quarters of the way between that line and the 10-degree line. This means that you are off by about $7\frac{1}{2}$ degrees (the approach error), possibly because the wind was stronger than you anticipated. Therefore, if you alter your heading $7\frac{1}{2}$ degrees to the left, you will fly parallel with your course. This isn't good enough to get you to your destination, so now you look for the closing line—the



10-degree line from point "B." If you find that you're about half way between course and 10-degree line, which means that your closing error is 5 degrees. Therefore, if you alter your heading $7\frac{1}{2}$ plus 5 or $12\frac{1}{2}$ degrees to the left, you will come right in on your destination.

A second method, which is more commonly used, requires the drawing of only one set of 10-degree lines—the ones from the starting point. As before, you are $7\frac{1}{2}$ degrees in error, so if you alter your heading double the course error you will get back on course in exactly the same time as you took to get off it ($7\frac{1}{2}$ degrees to parallel course; $7\frac{1}{2}$ degrees more to get back on it). Remember, you have turned off 15 degrees to the left. Once you are back on course you then turn $7\frac{1}{2}$ degrees to the right (leaving you $7\frac{1}{2}$ degrees to the left of the original heading) which will bring

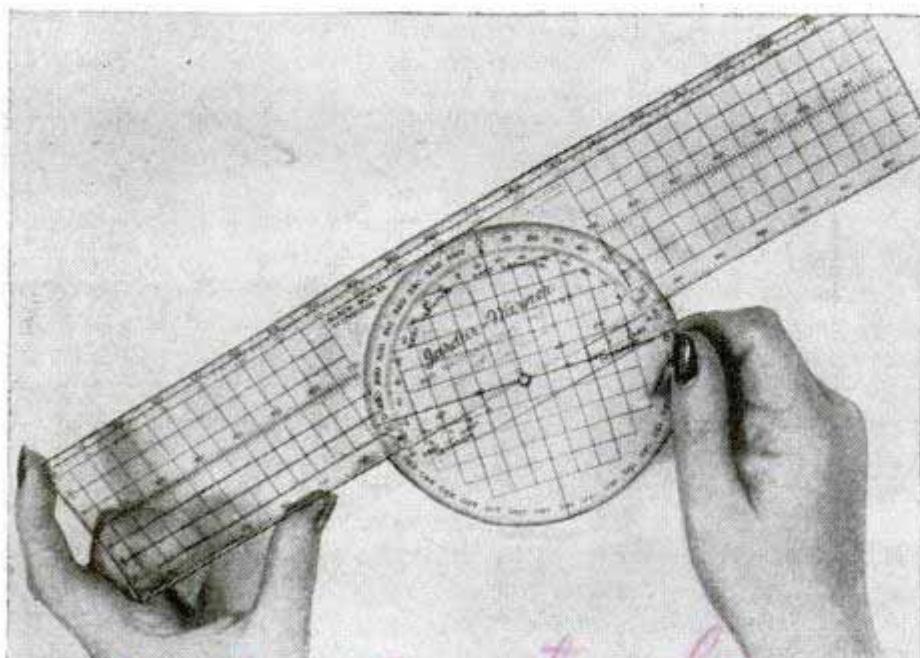


Instrument panel on a Piper Cub is simple, but it tells essentials for the average private pilot

you right along the course to the target.

Now to make use of the five-minute intervals. The trip as originally planned would have taken 37 minutes; the pinpoint you got was about the 14-minute time interval, although only 12 minutes had gone by since setting course over point "A." This puts you two minutes ahead in 14; in 37 you will therefore be about five minutes ahead. That is, your revised E.T.A. will be five minutes earlier than you planned; if course was set at 15 minutes past 10, the

This is one of the ingenious, handy plotters for determining a plane's bearing and position



new E.T.A. will be 10:47, instead of 10:52. This knowledge helps a lot to keep you from sailing right past point "B" without noticing it.

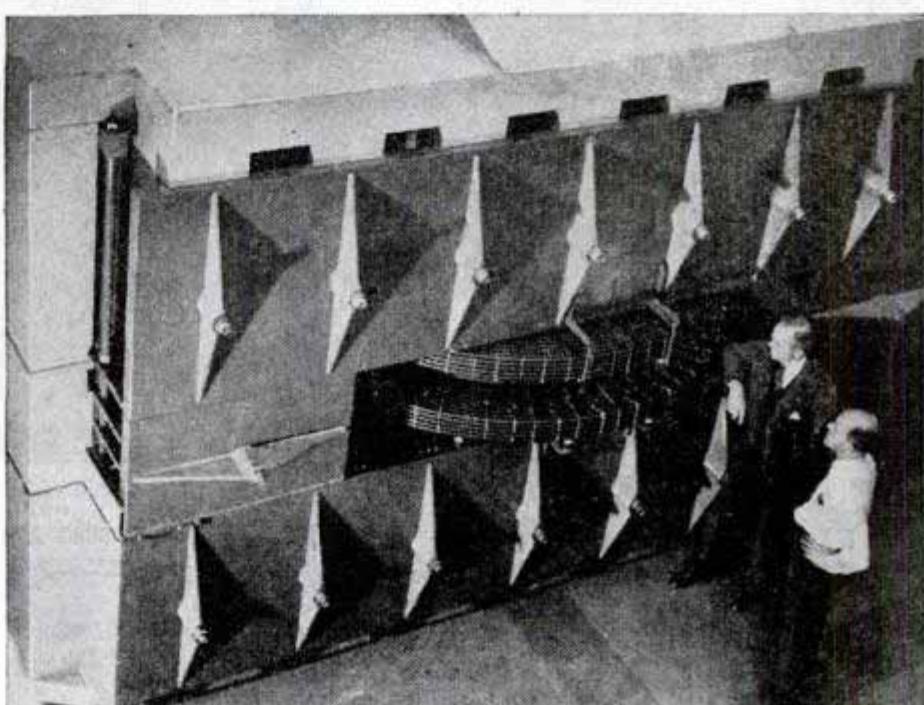
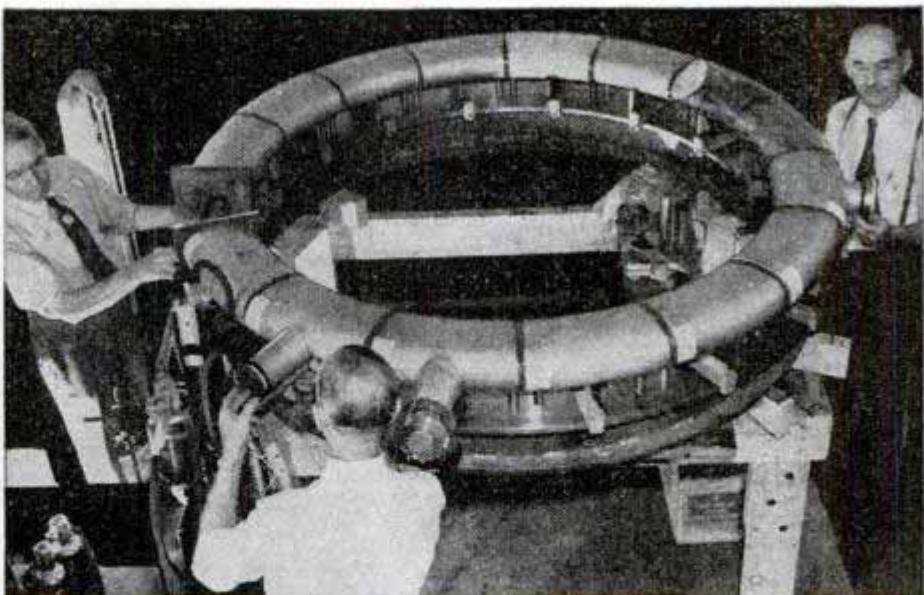
Most important in all navigation is a complete familiarity with the maps you use. The ones employed most often in the United States are the Sectional Aeronautical Charts issued by the U. S. Coast and Geodetic Survey, with a scale of 1:500,000, which is approximately eight miles to the inch. In reading maps, you must remember that the map is not a picture of the ground over which you are flying; at best it is a two-dimensional and therefore distorted representation of it. If the middle ages had been correct in their belief that the world was flat, it would have been much simpler for the cartographers and for everyone interested in navigation.

There is another reason why maps are distorted. A three-lane highway, which is an excellent landmark from the air, may be only about 36 feet wide. On a map with scale of eight miles to the inch, this would correspond to a line less than a thousandth of an inch wide. For seeing and printing purposes, the road must be represented

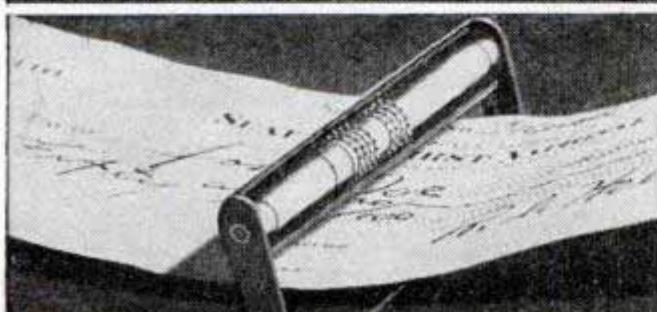
(Continued to page 150)

Atomic Secrets May Be Unlocked By X-Ray Machine

Great strides in the use of X-rays and other types of electrical radiations in atomic research, medical therapy and industry are predicted with the revelation of details about the war-secret 100,000,000-volt electron accelerator, or betatron, built by the General Electric research laboratory. The new machine produces the most powerful X-rays ever created—so powerful they will penetrate thicknesses of metal greater than the 12 inches of steel that can be pierced by 2,000,000-volt industrial X-ray units. Even more exciting to scientists, however, is the fact that with the electron accelerator, radiations formerly present only in cosmic rays now can be generated in laboratories. The principal part of the machine is a huge electromagnet made of 130 tons of laminated silicon steel. In a rectangular opening passing through the magnet are pole faces, 76 inches in diameter, surrounded by large coils of insulated one-inch copper conductor. The heart of the machine is a doughnut-shaped glass vacuum tube from which is projected an elec-



tron gun equipped with a heated filament. In operation, the ray maker accelerates electrons until they reach approximately the speed of light—186,000 miles a second.

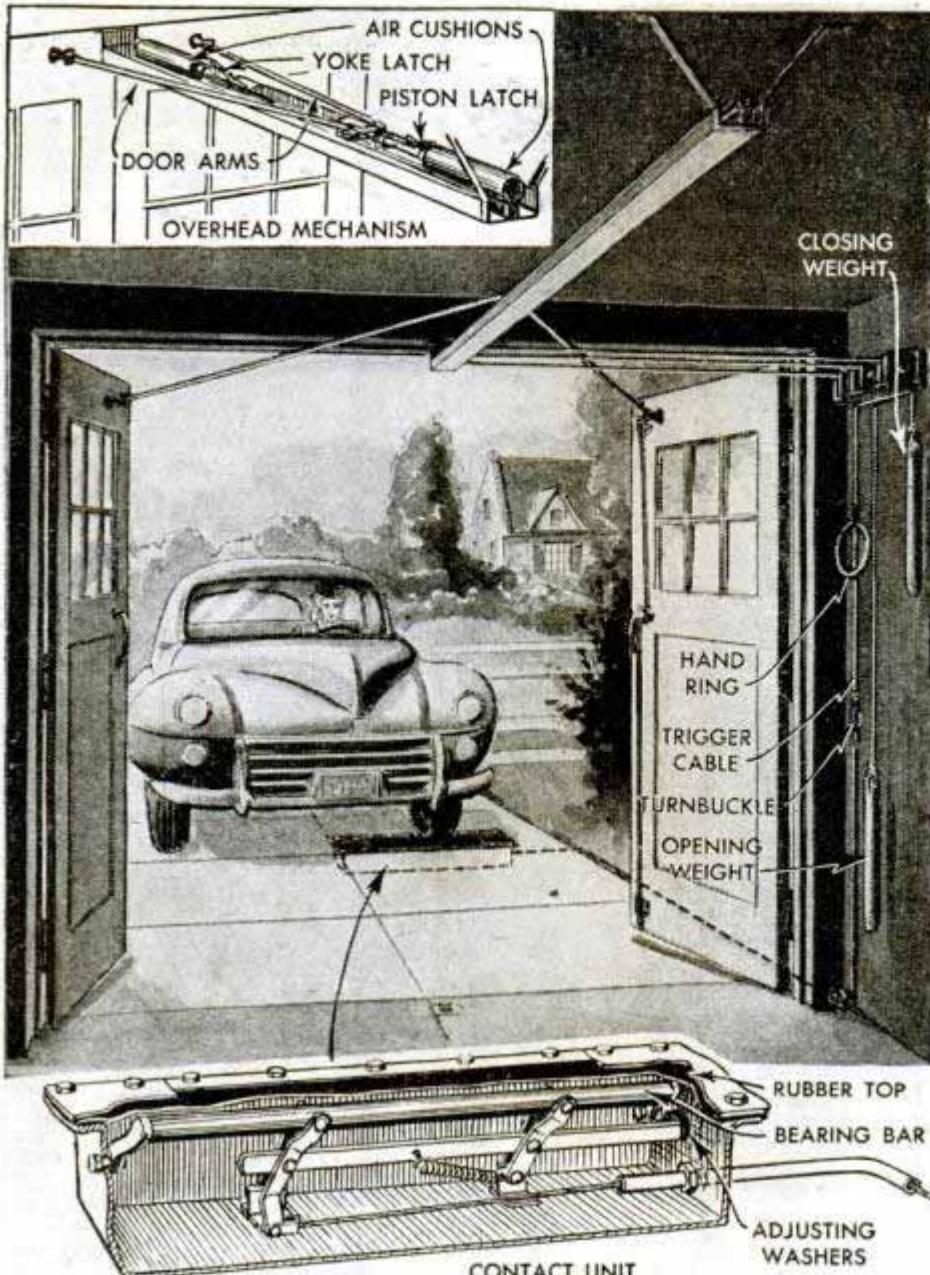


Pocket-Size Check Perforator

Richard I. Heller, a Pasadena, Calif., salesman, wrote a check for \$80. A forger "raised" it to \$800. So, to protect himself against any such recurrence, Heller invented a pocket-size check protector, a perforating device through which he pulls checks to make tiny ridges on their surface and thus prevent any tampering. Heller designed a combination check holder, wallet and perforator that takes no more space than an ordinary wallet.

IF YOU WANT TO BUY IT—

Write to the manufacturer or distributor listed in the Where-to-Buy-It Index to learn more about commercially available products described in this magazine. Say you saw it in Popular Mechanics.



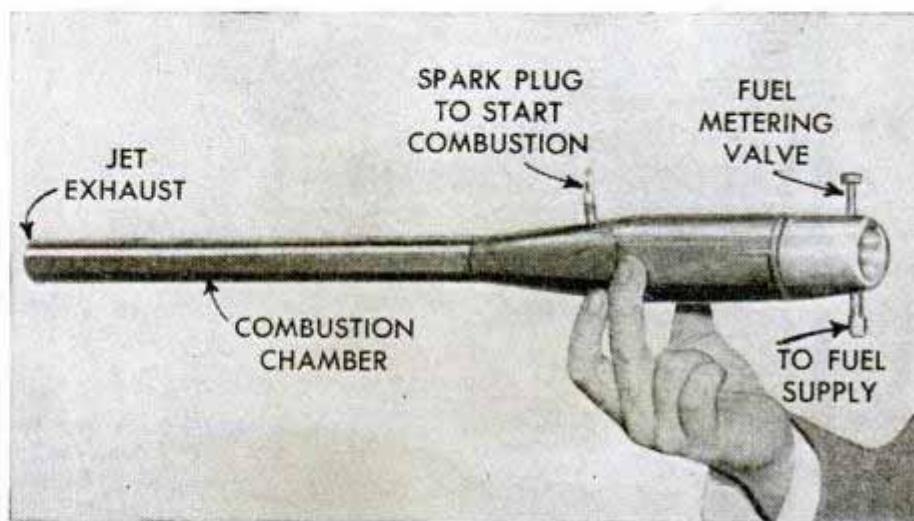
Garage Doors Open When Car Crosses Control

Garage doors are opened and closed by an automatic door operator whose motive power is derived from weights mounted on the wall. A wheel of the automobile touches a contact unit in the driveway, actuating a cable pull that releases the door-closing weight when doors are open, and the door-opening weight when doors are closed. Slamming is prevented by cushioned parts in the overhead unit. In getting the car out of the garage, the driver opens the doors by hand as usual. They close as the car goes over the contact unit. On returning, the unit opens the doors, and the driver closes them by hand. No electricity or other power is used in the operation. The contact unit is watertight, weatherproof and dirtproof, and will operate satisfactorily under light snow.

Jet Engine Modeled After V-1 Has No Rotating Parts

Powered by gasoline or kerosene, a jet engine designed by West Coast engineers has no rotating parts and operates on the buzz-bomb principle rather than that of conventional jet engines. The engine consists of a stainless steel tube, part of which serves as the combustion chamber, plus a streamlined tube containing a fuel metering device and a spring type flutter valve. Air and fuel pass through the valve and are ignited in the combustion chamber. The back pressure resulting from the explosion seals the valve and thus creates the forward thrust. The engine has a firing rate of approximately 250 explosions per minute. A model of this design two inches in diameter, two feet long

and weighing five ounces exclusive of fuel tank produced two pounds of thrust, or enough to provide one G of acceleration in vertical flight in a one-pound model airplane. Called the "autoflight," the engine is started by introducing an air blast through the front opening.



THEY POLICE CALIFORNIA'S RAIN

CALIFORNIA doesn't have an official rainmaker on its state payroll but it does have the next best thing—a state division of water resources that takes charge of the rain after it has fallen.

The experts of this division measure the rain and snow, forecast and partly control the flow to the sea, and help put the water to work in half a dozen different ways en route.

One result is that the owners of three million acres of rich land can learn ahead of time how much irrigation water from melted mountain snow will be available for them during the dry summer growing season. They select their crops and schedule their planting to make best use of the water they will receive.

Another result is that utility companies know which of their hydroelectric plants will receive the most water and which plants must store water for use later on, and thus are able to draw power from different stations so as to make best use of the water.

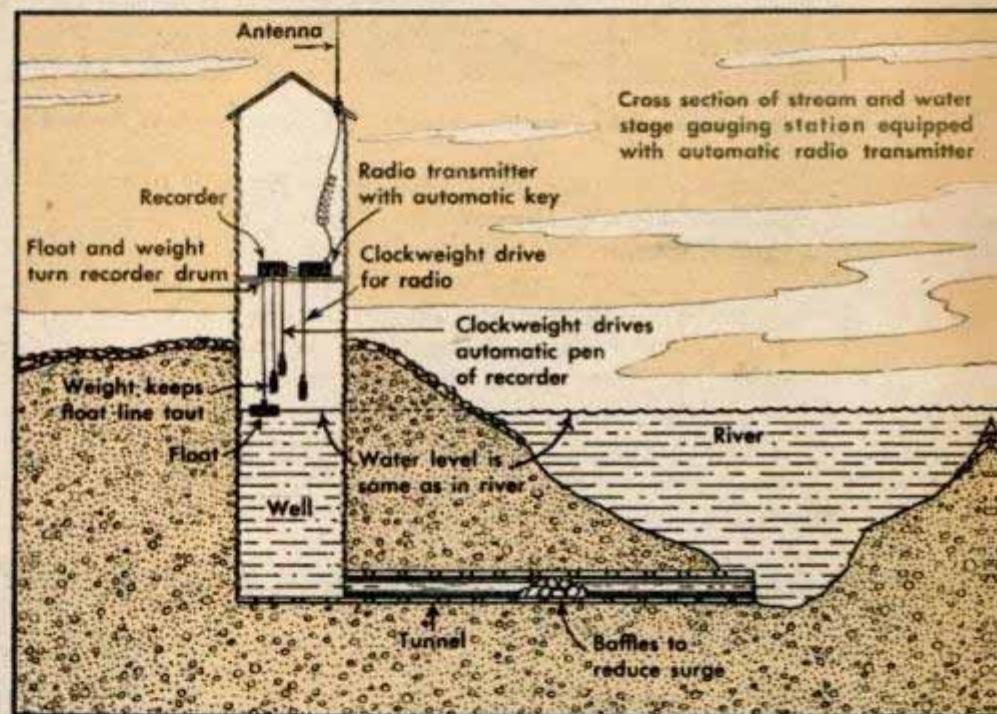
A third benefit is that warnings of floods are broadcast well in advance and it is possible to control and confine the excess water so that damage is minimized.

Flood warnings are especially important in the lower Sacramento River area because this river system contains a number of wide by-pass channels, normally devoted to agriculture, into which flood waters may have to be diverted to prevent breaching of levees along the river's main channel. The by-passes contain 80,000 acres on which beans, rice, asparagus and other crops are grown. Adequate warnings when the by-passes must be flooded give the inhabitants time to move their livestock, equipment and valuables to safety.

Flood forecasts are based on up-



Meteorologist inspects a current flow meter used to measure the rate at which rivers discharge water during big floods



Drawing illustrates operations of water stage gauging station shown below, where height of a stream is recorded by inspector



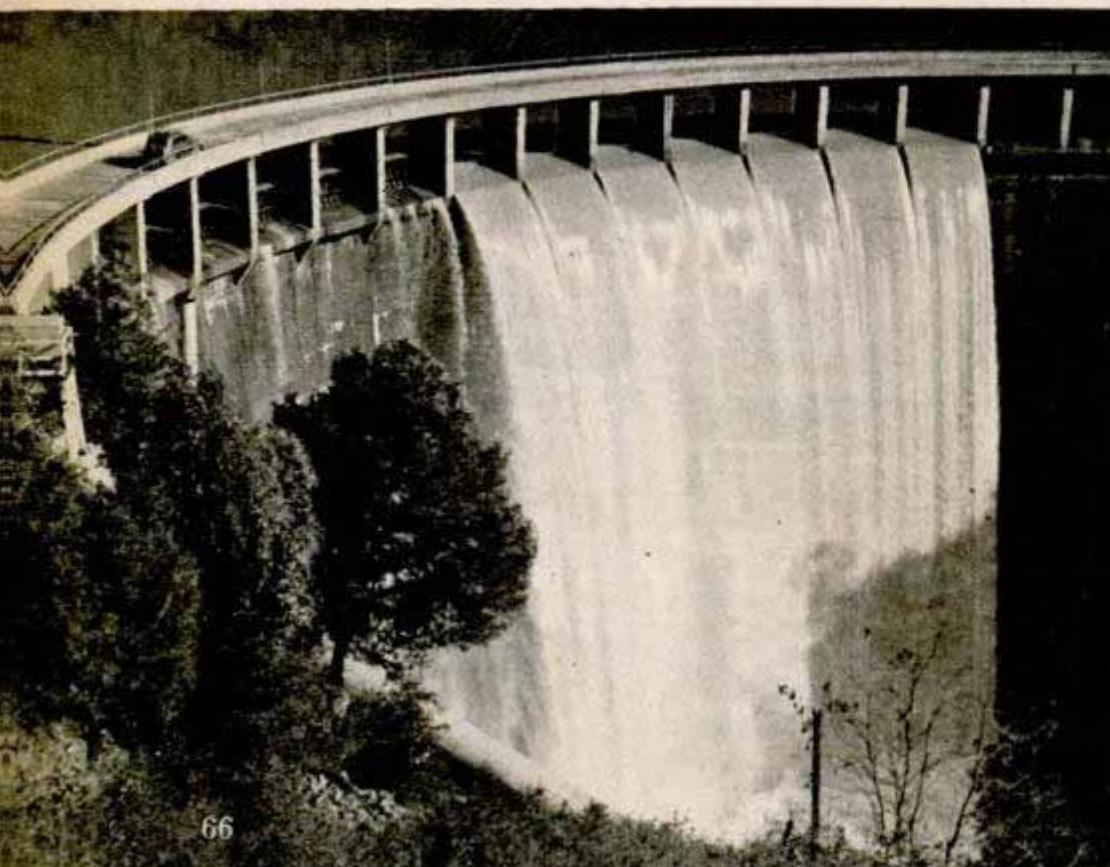


Radioman at Sacramento records high water reports flashed by automatic measurers and radio transmitters

stream measurements of high water and in particular on the water depths at key gauging stations that are untended but that automatically report their readings by radio to the Sacramento headquarters. The automatic radio transmitters are used to make certain that the information will reach Sacramento even during storms that may disrupt telephone and telegraph circuits. Gerald H. Jones, the supervising hydraulic engineer, translates the radio

measurements into forecasts on the height of the flood and the time at which its peak will reach the populated areas in the lowlands. His forecasts are accurate to within one foot, three days ahead of time, and he refines these predictions to within one or two inches of the actual crest about eight hours before the peak arrives.

An automatic gauging and radio transmitting station consists of a small shelter placed on top of a well that is dug into the bank adjacent to a river. River water may be too turbulent for measurements in the open stream and so the height of the river is obtained by measuring the height of the water in the well, the bottom of which is connected to the river itself by means of a lateral tunnel. The measuring device consists of a float that rests on top of the water, with a thin flexible line that leads up to the instrument shelter. Here the line is wound around the drum of the automatic recorder, with its free end held taut by a weight. Raising or lowering of the



Spring run-off water pours over spillway of a California dam

water level thus rotates the drum. An automatic pen, driven by clockweights, makes a record of the drum's movements.

The companion automatic radio transmitter consists of a battery-powered 5-watt set that is turned on at hourly intervals by a clockwork mechanism driven by clockweights suspended in the well. The keying device is connected by a gear train to the drum of the automatic recorder so that it transmits dots and dashes that are based on the drum's position. Each of the automatic transmitters signs off with its own station call letters. These stations are serviced and their clockweights are reset once a month.

Too much water for short periods is not unusual during a California winter and yet, literally speaking, it doesn't rain in the state's central agricultural region at all during the rest of the year. Summer agriculture would be impractical except for the 33 million acre-feet of water, more or less, that fall in the form of snow each winter in the Sierra Nevada mountain range. The snow covers an area of 17,000 square miles and begins to contribute water to streams and irrigation ditches at about the time of the last spring rains.

A heavy snow pack in the mountains means that water will be available all summer long for vast agricultural tracts, while sparse winter snow means that little or no water will be available in some districts after the spring run-off.

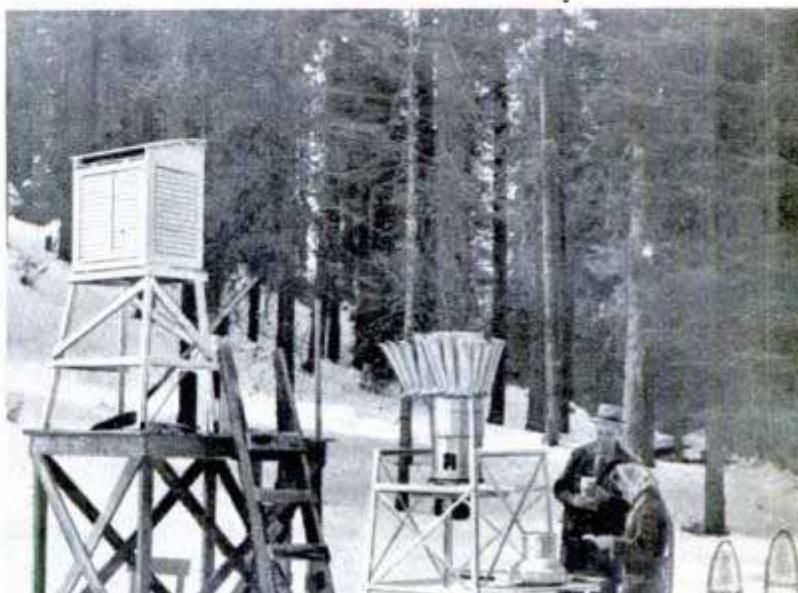
To discover ahead of time what the summer water "crop" will amount to, federal and private agencies cooperate with the state in measuring the mountain snows each spring. As many as 150 experienced mountaineers participate in the snow survey under the direction of Fred H. Paget, state associate hydraulic engineer. Carrying equipment on their backs and usually traveling on skis, the men climb as high as 11,000 feet to measure the snowfall in 24 different watershed areas.

Left, snow measurer arrives at cabin he will occupy. Right, ranger checks weather recordings in national park
National Parks Service photo



Snow packed in aluminum measuring tube is weighed to learn the amount of flood water it will produce

Food-stocked cabins in which the men sleep on these trips have heavy bars across their windows to keep out bears. Cabins located in regions of excessive snowfall are equipped with a low tower on the roof, with a trap door on top of the tower and another at the tower bottom, opening through the roof and leading to a ladder inside the cabin itself. Such a cabin may be completely buried when the survey party approaches it. The men remove the door from the top of the tower, let themselves down to the roof and through the second trap





Severity of approaching floods is forecast by checking a river chart that compares river heights in Sacramento area

door, and then descend into the cabin.

Snow may pile up in drifts 100 feet deep in some Sierra valleys. Snow surveys, however, are made on level areas that are free of drifts, on sites marked by tall poles. Depth of the snow at one of the survey points rarely exceeds 17 feet. The depth is measured by means of a hollow aluminum

tube which also cores the snow as it is forced down. After removal, the tube and its snow load are weighed on a special scale and the water content of the snow is determined. Fresh snow contains an inch of water per 10 inches of snow; after it has settled for several months it may hold up to six inches of water per foot.

These snow measurements are compared by Paget with the survey figures of past years and form the basis of a water forecast that he issues early in April. The first forecast is accurate to within 10 percent and is followed by supplementary reports at 30-day intervals showing the rate at which the snow is melting, a figure that varies with high or low spring temperature.

This run-off information is based on the readings at the stream gauging stations, both radio and visual recording types. The run-off is plotted in a curve, day by day, and this shows when the peak of the run-off is reached in each district. Hydroelectric plants close their dam gates at this point and begin to store water, power meanwhile being produced at other plants on rivers that still are high.

Predictions based on the snow surveys have safeguarded agriculture during both extremely dry and extremely wet years. When a snow sur-

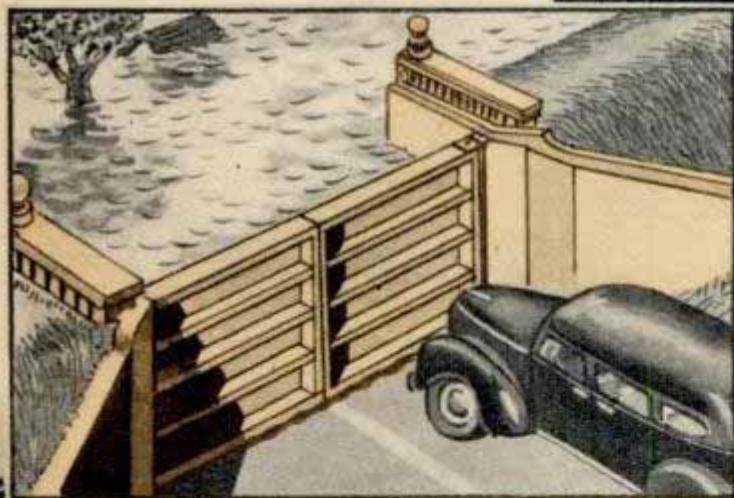


Spillway model at California Institute of Technology aids study of water in designing of waterworks systems

vey forecasts a serious shortage of summer water, farmers are advised to plant crops requiring a minimum of water. Men who had planned to plant rice, for instance, are able to shift to "dry" crops that will mature with the small amount of water available.

On the other hand, if the snow survey indicates a tremendous run-off with a threat of inundating thousands of acres of farm lands, the water in storage reservoirs is immediately reduced so as to provide storage space for the coming floods. Levee systems are inspected at the same time and weak points are strengthened.

There are some two dozen major dams in California in addition to scores of smaller structures. These control only a fraction of all the run-off water in the state. Additional dams eventually will end the threat of floods, provide more power, more water for agricultural areas, and will allow additional untilled tracts to be brought under cultivation.



Above, skiing weather man takes time out from measuring snow to get a drink. Left, heavy iron gates block California highway and stop flood water from crossing levee. Below, when there is no high water, gates are kept open to permit automobile traffic to move on concrete road through the levee section





Just push a button and this luxurious club divan for railroad cars is converted into a sleeping unit. Designed by Nathaniel D. Arnat of Baltimore, Md., the sleeper will make bed-making easier for the porters

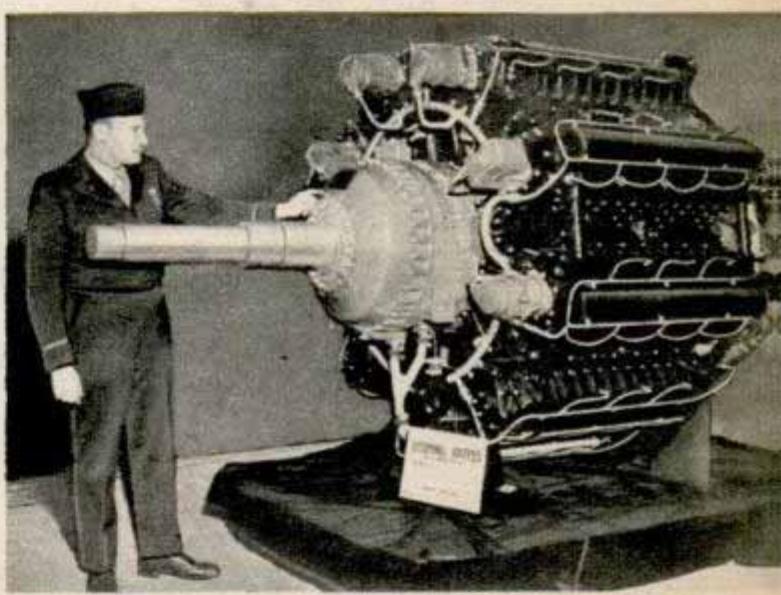


Clamped to a bed, this bottle holder saves mothers the time and trouble of standing over their babies during the feeding. When the milk is gone and baby moves its head, the holder moves the bottle away



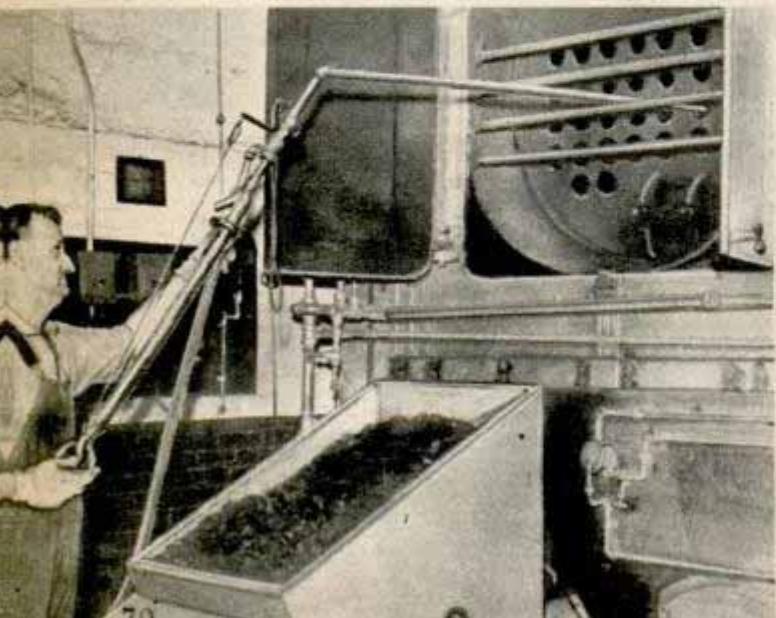
These hardy men expect to sail from Sidney, Nova Scotia, to England in 80 days in this "beer barrel" boat equipped with a keel, two vanes and a rudder

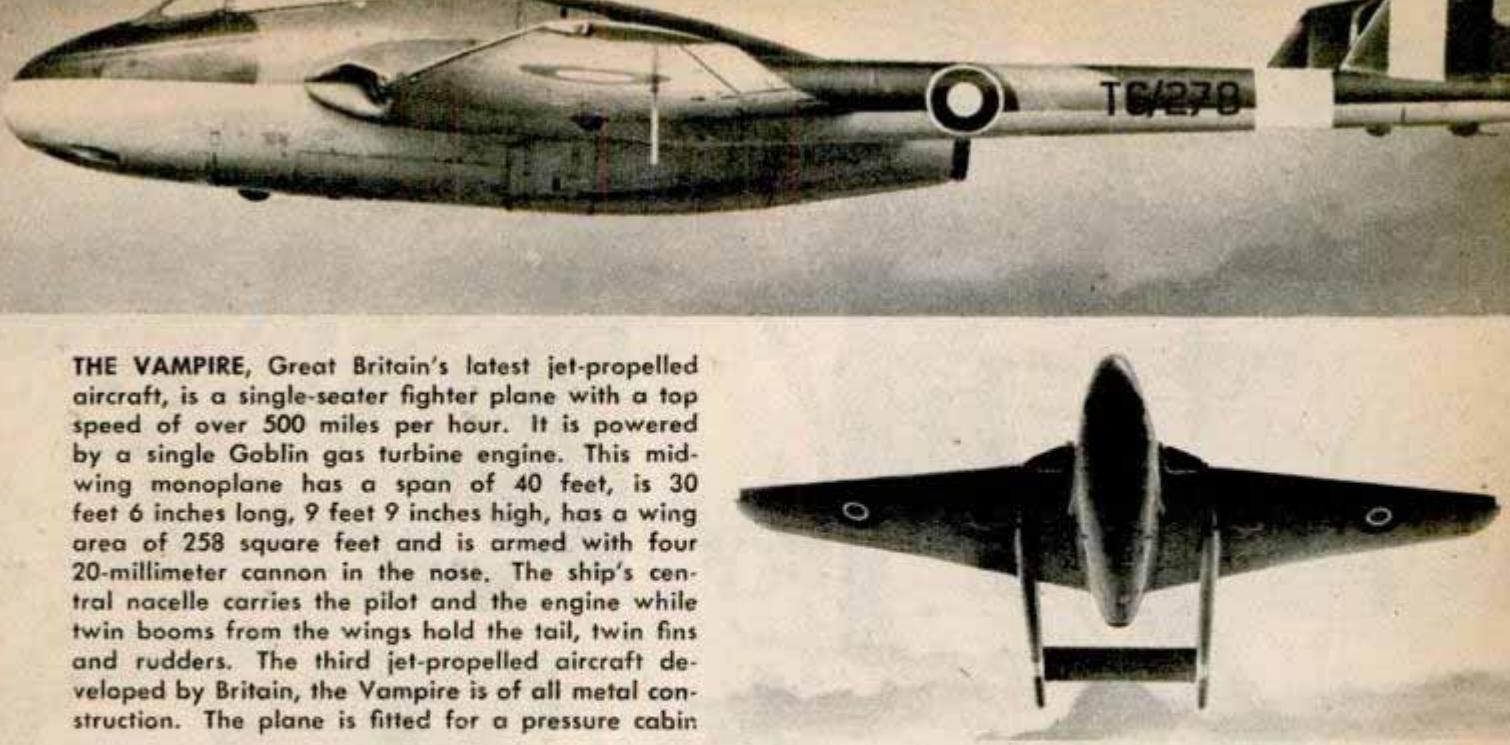
Coal soot lodged in boiler tubes is blown out with a compressed air cleaner made from a shovel handle, pipe, chain release and a metal disk on the pipe end



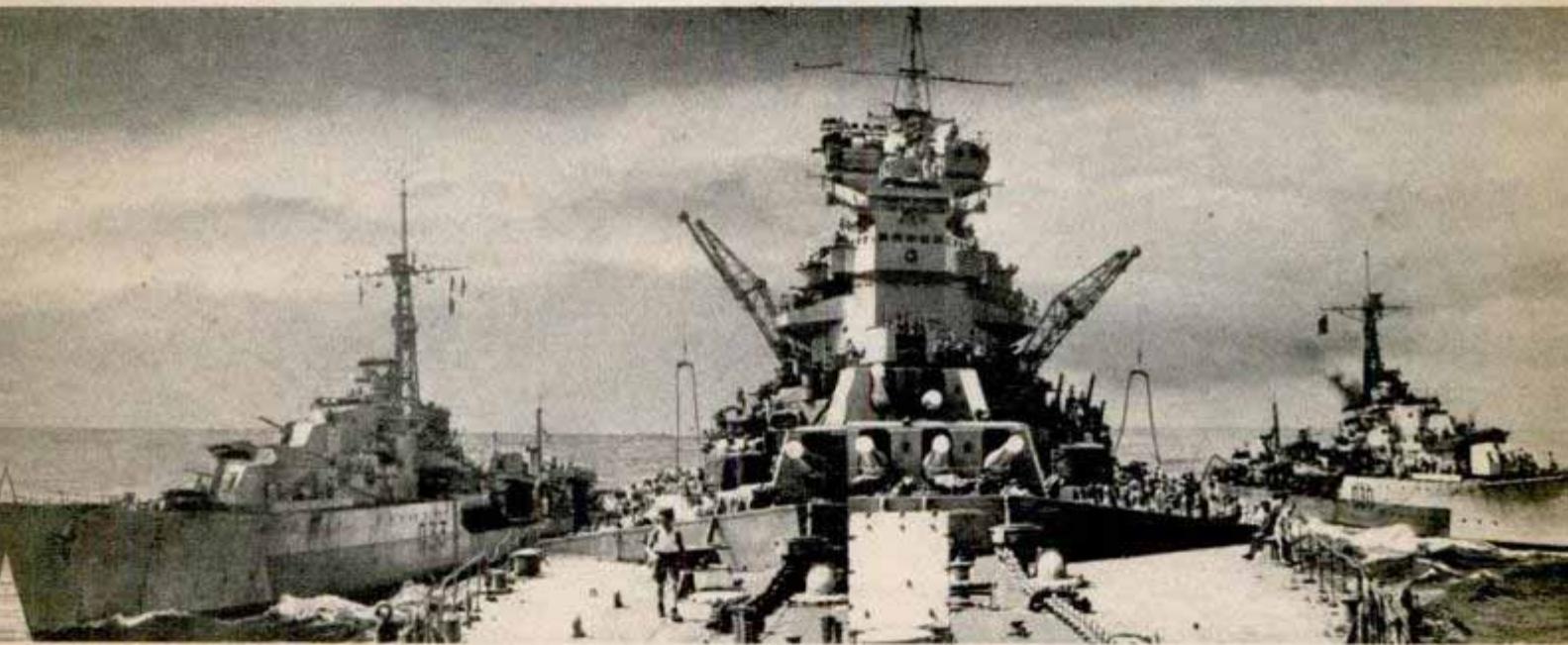
Most powerful engine developed for the AAF by the Power Plant Laboratory at Wright Field, this 5500-pound giant has 36 cylinders and develops 5000 h.p.

Irving Amstadter of Chicago used stamps to make this U. S. map. Stamps were placed in the home states of the persons pictured, Abraham Lincoln in Illinois, etc.





THE VAMPIRE, Great Britain's latest jet-propelled aircraft, is a single-seater fighter plane with a top speed of over 500 miles per hour. It is powered by a single Goblin gas turbine engine. This mid-wing monoplane has a span of 40 feet, is 30 feet 6 inches long, 9 feet 9 inches high, has a wing area of 258 square feet and is armed with four 20-millimeter cannon in the nose. The ship's central nacelle carries the pilot and the engine while twin booms from the wings hold the tail, twin fins and rudders. The third jet-propelled aircraft developed by Britain, the Vampire is of all metal construction. The plane is fitted for a pressure cabin.



GREAT BRITAIN'S 35,000-ton battleship, the Duke of York, refuels simultaneously two British destroyers at sea

AN OLD TRUCK fitted with special rims rides wooden rails to carry men and machinery seven miles over swamplands to a gold mine in western Quebec, then turns around on a crude turntable fashioned out of pipes



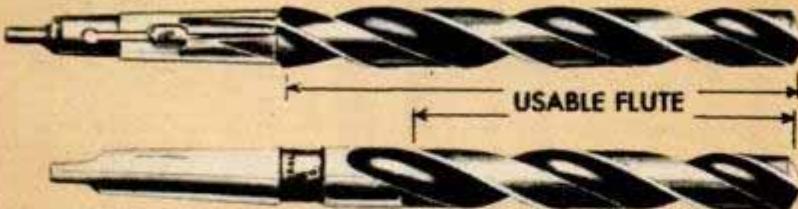
MONSTER and



Mesta Machine Co. photo

Drill being inspected makes gun bores in 155-millimeter canon. Below, shankless and conventional drills compared

SHANKLESS ROLL-FORGED HIGH SPEED DRILL

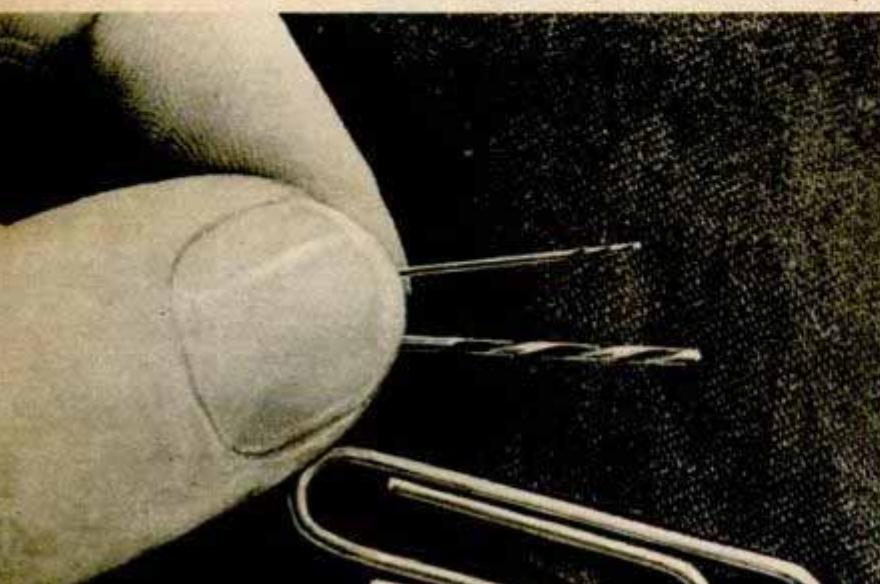


CONVENTIONAL TAPER SHANK HIGH SPEED DRILL

SPINNING faster than a whirling dervish in countless factories and assembly plants are the drills that never get to display their precision on the parade ground. It takes a lot of holes to put mechanized equipment together, and it takes a lot of drills to do the job, from the needle-sized $\frac{1}{64}$ -inch baby to the 5 $\frac{3}{8}$ -inch monster that drills 155-millimeter gun bores.

The small drill for years was made only in Germany and Switzerland and in peacetime was used mostly in watchmaking and similar fine work. During the war it was found useful for puncturing atomizer sprays and fuel jets for thousands of Diesel engines, and for making tiny holes in precision aircraft and electronic equipment. The atomizer nozzles of Diesel engines require very small holes to feed the fuel to the cylinders in the proper amounts and spray pat-

Diminutive $\frac{1}{64}$ -inch drill (top one of the two held between fingers at the left) is shown in comparison with an ordinary paper clip



MIDGET DRILLS

The granddaddy of the line bores the famous 155-millimeter "Long Tom"; the baby, as fine as a needle, drills tiny holes for fuel jets and atomizers in Diesel engines

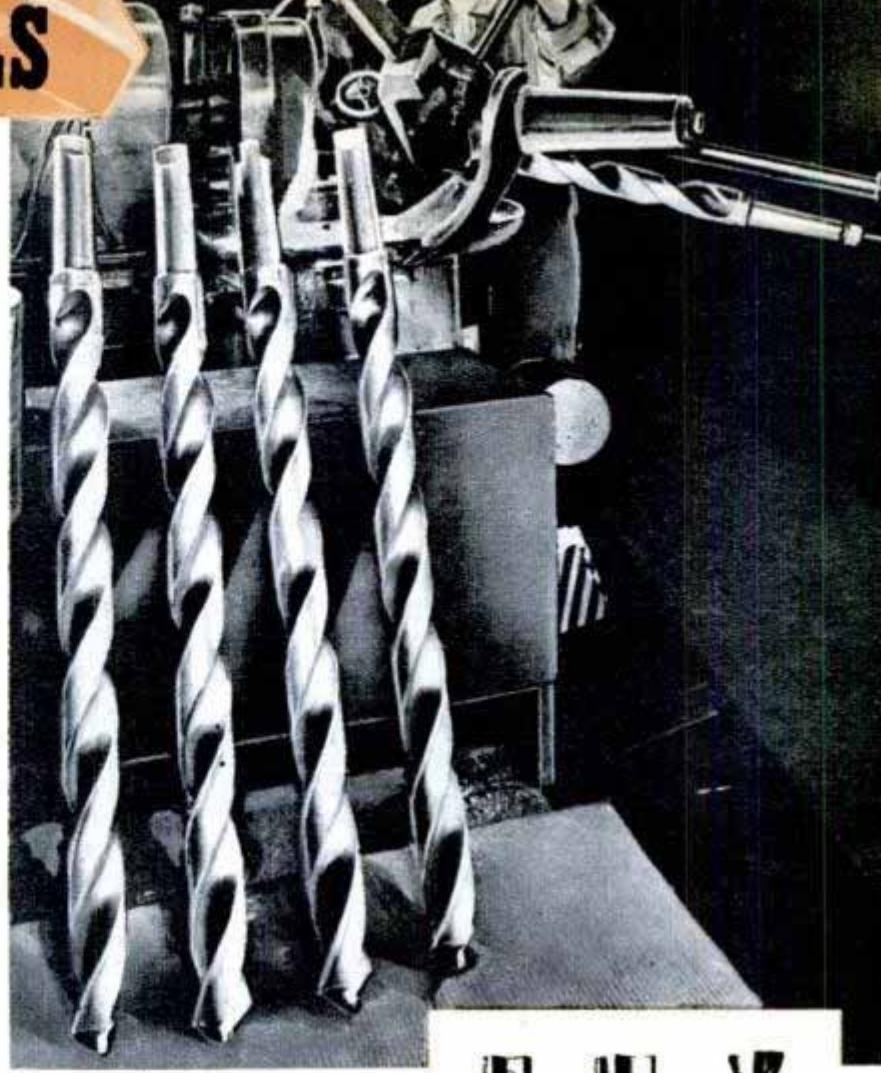
terns. These holes are made by the step drilling process, which means that the drill is moved up and down automatically during the operation in order to free the chips and allow lubricant to be applied.

The large drill was designed for a military purpose only, and so far has found no postwar demand.

A brand new drill industry sprang into being with the war, when demand for the tools led to mass production of the shankless drill. Invented years ago by an automobile executive, the shankless drill was not perfected and used until about six years ago, just before the patent expired. Organized only four years ago, a Chicago company has turned out more than 100,000,000 drills since then, most of them shankless. The plant was designed specifically for women workers, who constitute a majority of the firm's employees.

Conventional drills are made by milling flutes, with their cutting edges, in a bar of steel. The shank which fits into the operating tool is an integral part of the drill. The shankless drill is made from a bar of high speed steel with a groove on either side, as supplied by the steel mill. This bar is roll forged to add the cutting edge, and twisted while hot. The single process is simpler, quicker and less costly.

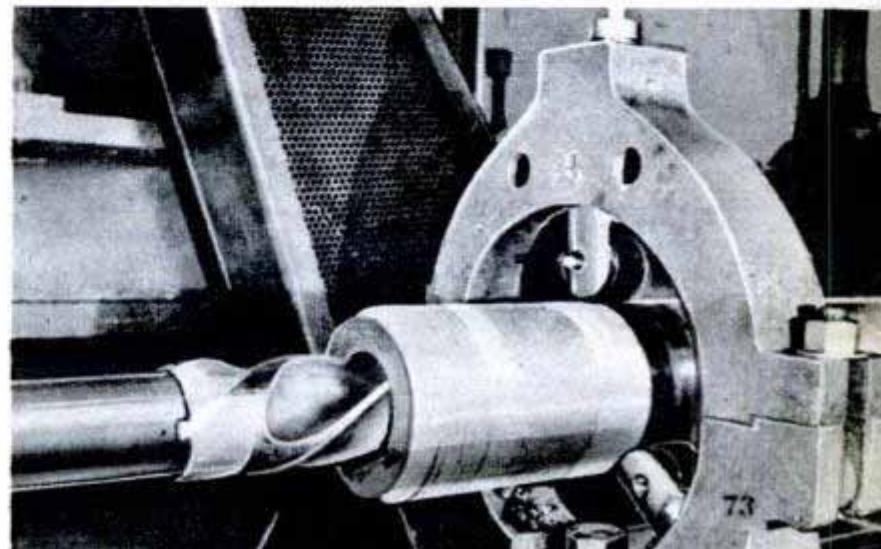
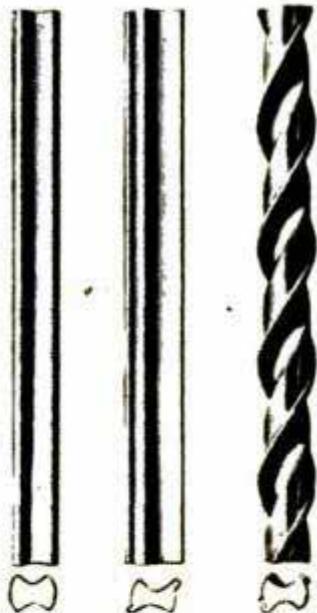
Shankless drills must be used with an adapter, which fits over the end and is inserted in the operating tool. The design permits a 25 to 40 percent increase in the usable portion of the cutting edges, as compared with a conventional drill of similar size. The shankless drills come in 135 sizes, from $\frac{1}{4}$ inch to 2 inches in diameter. Only seven sizes of adapters are required for these drills. Smaller and larger drills are made by the process of milling the flutes.



Four drills, $3\frac{1}{2}$ inches in diameter, await inspection after having been milled on machine pictured in background

Republic Drill & Tool Co. photo
Three-stage drawing, right, illustrates the steps required to make a shankless drill by first roll forging, then hot twisting

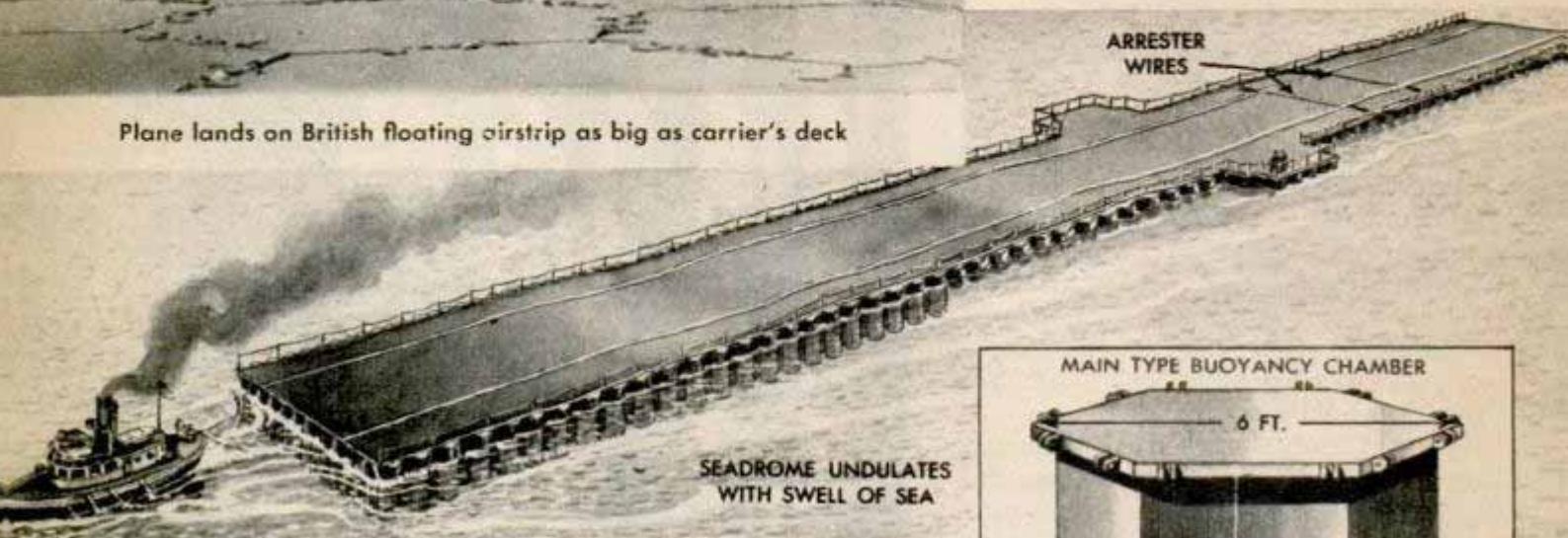
Shown in action below is monstrous drill measuring $5\frac{3}{4}$ inches in diameter, used to make bore in "Long Tom" gun



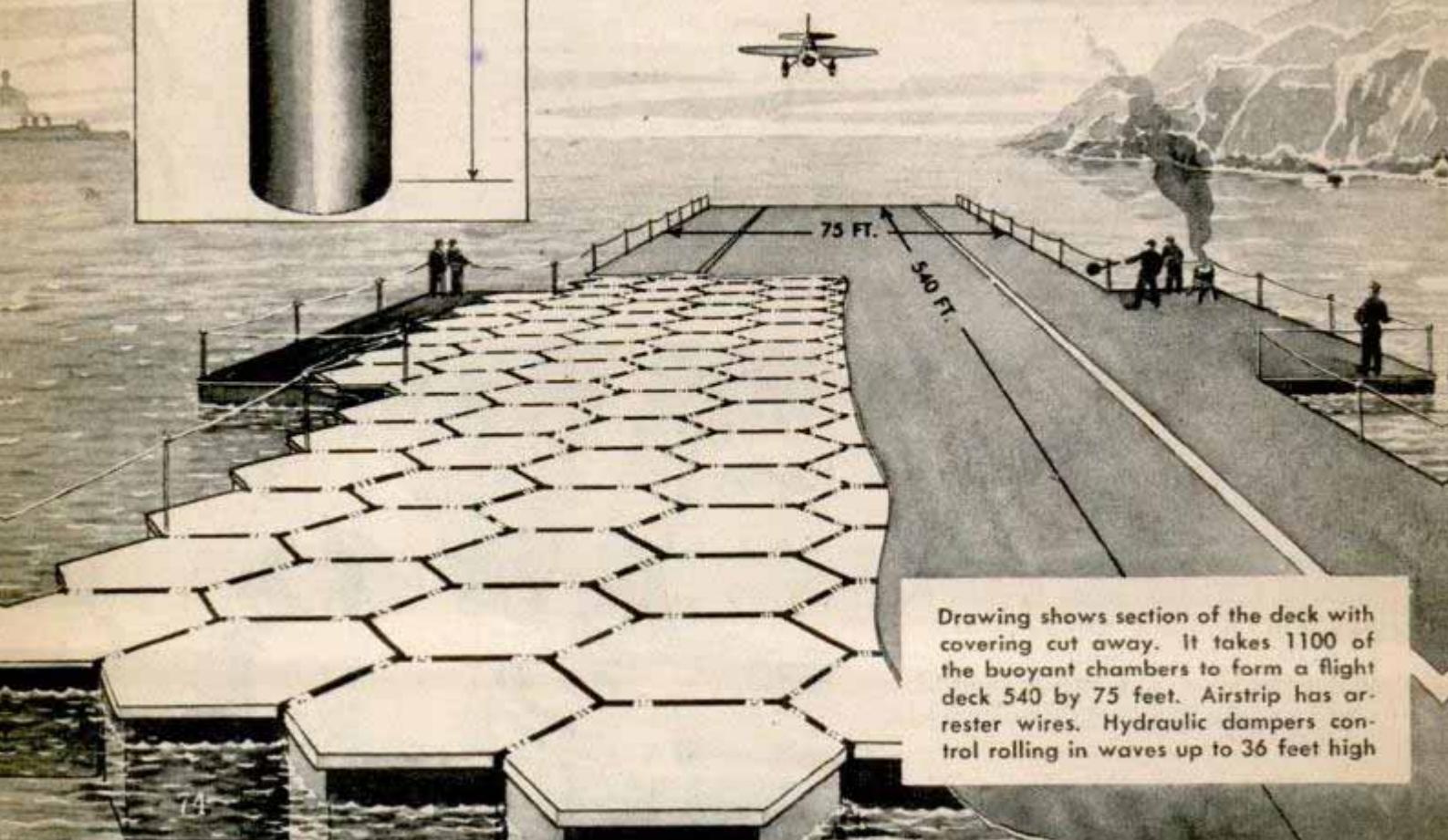
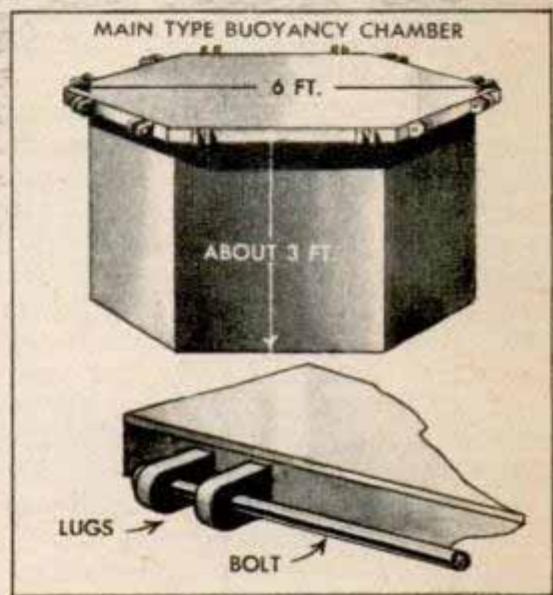
Floating "Honeycomb" Airport



Plane lands on British floating airstrip as big as carrier's deck



Rear section of seadrome is made of hollow steel chambers (right) that are bolted loosely to permit rolling with the waves. Forward chambers (left) of steel "honeycomb" are six sided on top, round at bottom, and deeper



Drawing shows section of the deck with covering cut away. It takes 1100 of the buoyant chambers to form a flight deck 540 by 75 feet. Airstrip has arrester wires. Hydraulic dampers control rolling in waves up to 36 feet high

Air Pictures Guide British Rebuilding

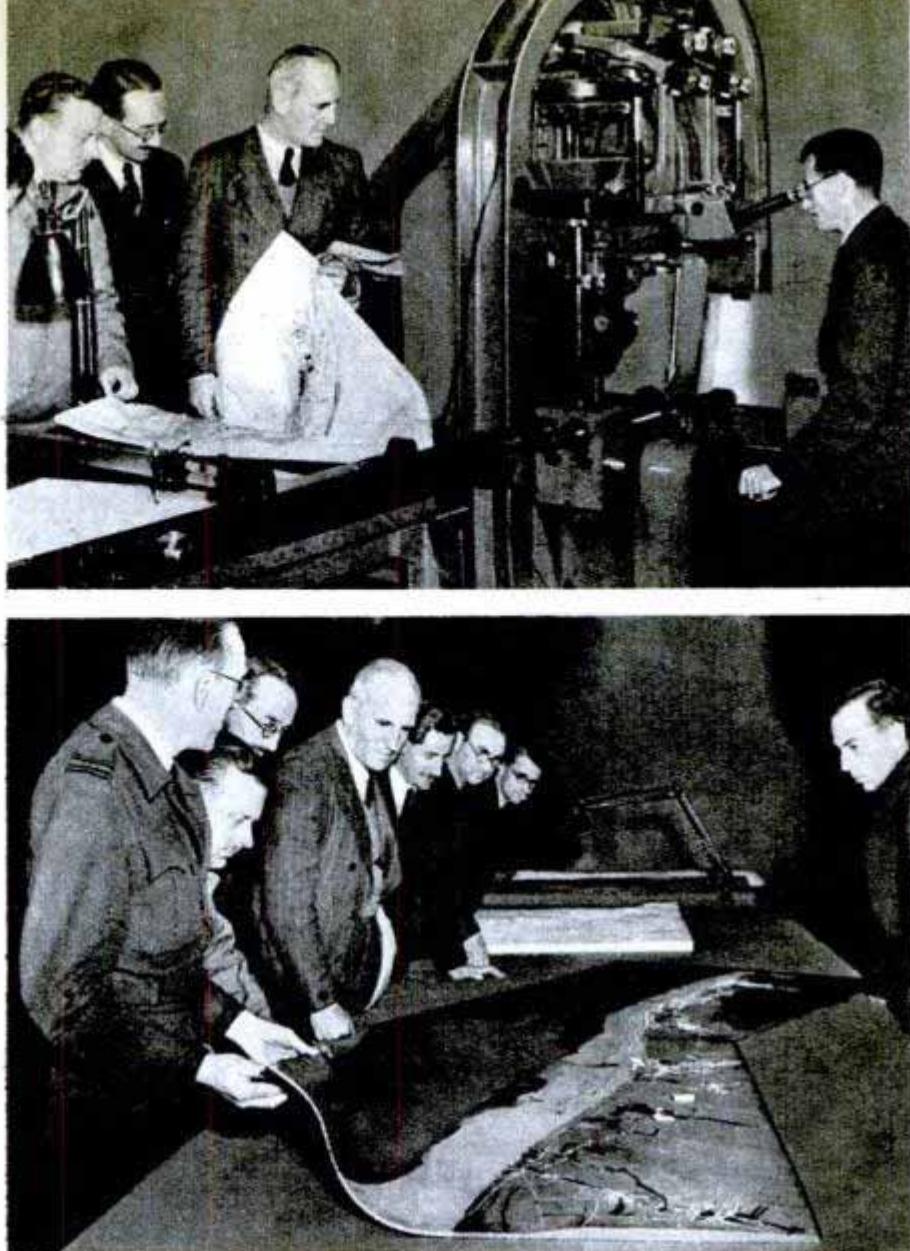
Royal Air Force flying photographers who used to dodge flak when taking pictures over enemy territory now make photographs of smashed cities and towns in England to help the Ministry of Town and Country Planning replace bombed-out homes, buildings, streets and parks. Many war-developed techniques are being used to simulate cities and countryside in model form. For example, aerial photographs are translated into synthetic rubber models that show exactly what structures were knocked out.

Robot Golf "Pro" Teaches Duffers

Keep your right heel down and you'll get a good drive, the golf professionals tell right-handed golfers. And now there's a practice machine that almost forces you to keep that right heel flat. Patented by Dave Bauer, a "pro" at Long Beach, Calif., the device has a small pedal on which duffers place their right heel. As long as the pedal is pushed down, it engages a lever that tees up a golf ball, all ready to

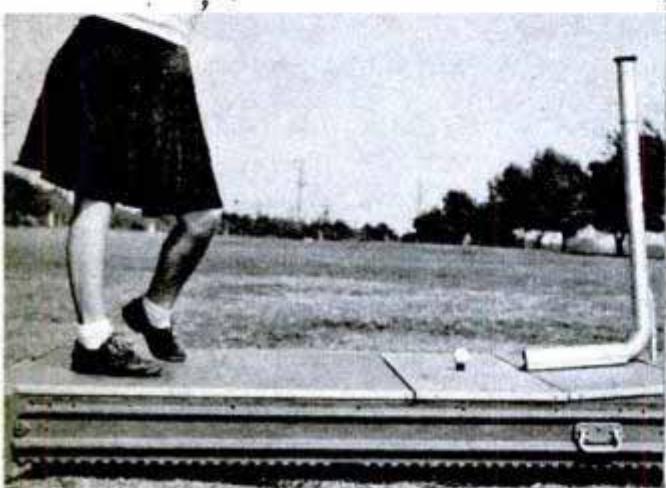
hit. If, however, the golfer raises his right heel—which probably would produce a poor shot—the pedal comes up and the teed-up ball goes down almost out of sight.

If you stand properly this device tees up a golf ball for you, but if you lift your heel the ball disappears

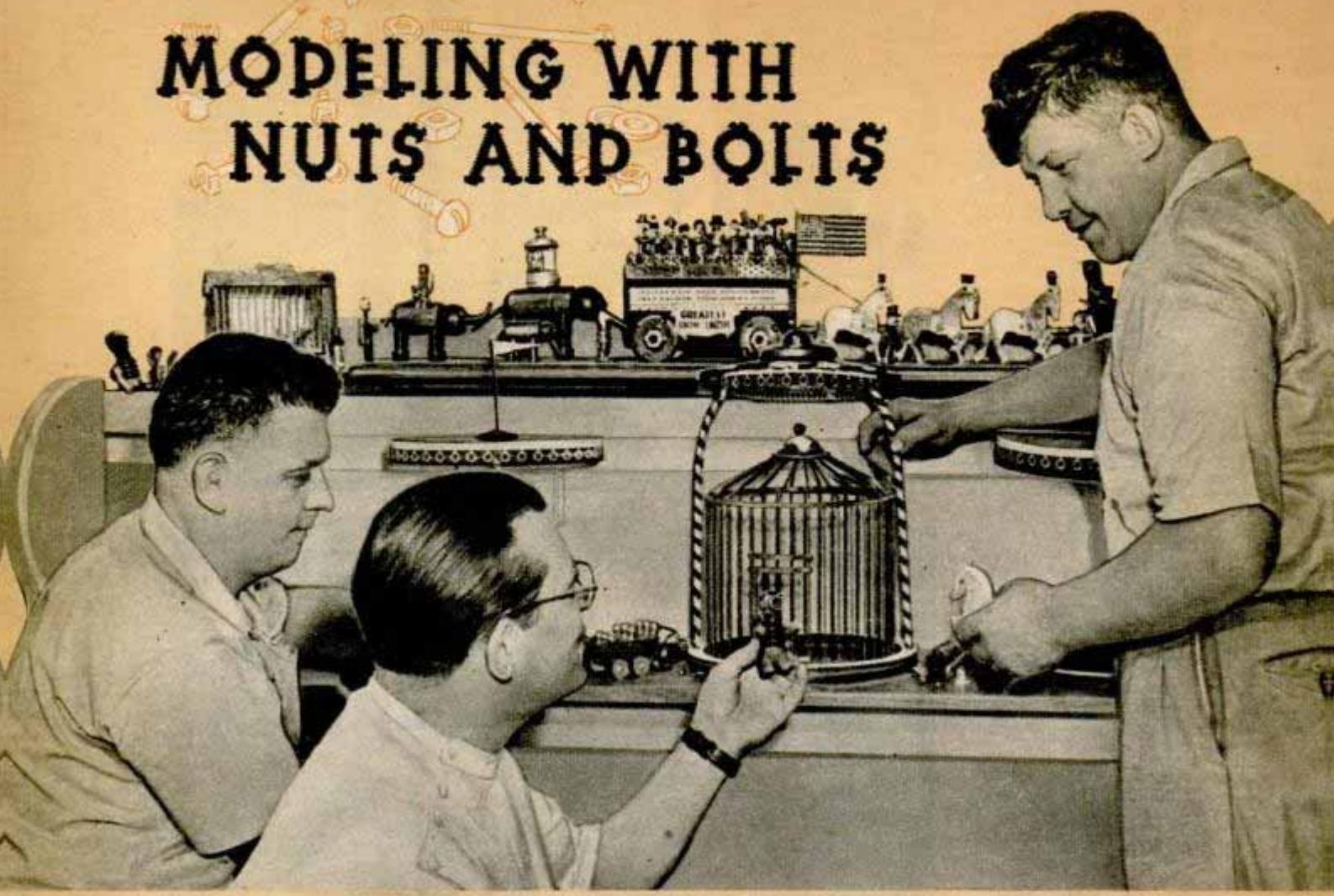


British Official photos

Photographs of enemy territory made by RAF flyers were transformed into maps by a machine and later studied by Allied military strategists



MODELING WITH NUTS AND BOLTS



Dr. Bernard H. Cooper (center) and helpers apply finishing touches to the world's most unusual circus

THE craftsman's scrap box is the inspiration of a unique hobby originated by a Cleveland dental surgeon. He has found endless and exciting possibilities in modeling with nuts and bolts and scraps of metal.

Slice the threaded portion of a bolt with a hacksaw and you have an excellent Stalin moustache. Cartridge cases are the arms or legs for small metal figures. With a little imagination an old bevel gear becomes a skirt for a native gal. Slotted boltheads make realistic eyes—even cat's eyes if the slots are placed vertically.

"In half an hour I can teach anyone how to turn junk pieces into models of persons or animals," says Dr. Bernard H. Cooper. "The main thing is to learn to see the possibilities in each item. Every piece of metal that has been machined, cast, or otherwise worked is a part that can be linked by the imagination with some everyday form, or can be combined with other forms to suggest something familiar."

Dr. Cooper, whose suite of dental offices is lined with his artistic efforts, has been an enthusiastic hobbyist for 15 years. He first became interested in masks of aboriginal Africans, and made scores of them. He carved bas-relief heads and figures in wood. He painted pictures. He created

By Walter E. Burton

plaques, masks and figures in plaster and clay. He turned out beautiful plaques and masks of hammered copper. He worked in plastics, and in 1941 won first place in a national plastics show.

His enthusiasm for making copper plaques ran into a snag in the form of war-created shortages: no copper, no more amusing caricatures of Joe Louis or stern likenesses of Maxim Gorky. He looked around for a new outlet for his excess energy. He found it in the scrap box. With bolts and nuts, wood screws, chips from metal-cutting lathes, worn steel balls from coal pulverizers, cotter pins, old gears and other odd bits of metal, he created amusing or significant figures, groups, and even a complete circus. So successful has he been in this new field that his scrap box creations are sought by museums for permanent collections. They even have been shipped, on request, to Russia for use in teaching the art in hospitals and schools.

Dr. Cooper has been assisted in developing his new hobby by George and Steve Jencso. Besides contributing their skill to the working of metals and the making of special tools, these brothers have done much to accumulate the amazing collection of scrap parts that furnishes Dr. Cooper

his raw material. Patients, hearing of the work, often bring boxes or bags of bolts, pipe fittings, and other metal items. Glass jars filled with these things overflow one of the doctor's workrooms; other bits of raw material hang on nails and hooks. A door marked "X-Ray Room" leads to a chamber where circus models and other large displays are put together. Visitors rounding a corner in the hallway are surprised by a workbench supporting a drill press, heavy vise, tools, an assortment of parts and half completed figures.

Dr. Cooper is convinced that his new hobby will become popular all over the world because it gives even the most unskilled person a chance to create something original and unique. Besides, the work is easy and fun.

The actual assembling of a figure is simple and often surprising in its results. An example he often shows prospective "junketeers" is the making of an African damsel from an old bevel gear, a rejected 37-mm. cannon projectile, two empty .50-caliber machine-gun cartridges and a short piece of thick-walled steel tubing. Dr. Cooper is especially fond of making aboriginal figures and fetishes, and has made a study of this form of art.

The bevel gear, placed with the teeth sloping downward, suggests a native skirt, so it becomes the base of the figure's torso. By setting the short piece of tubing on the

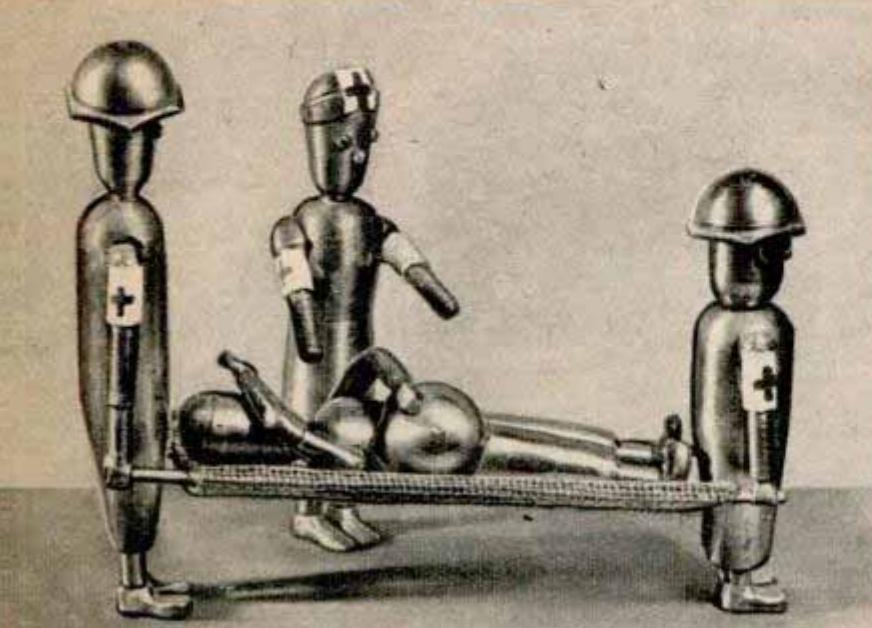


Saluting robot at left was made mostly from bolts and nuts. Before trio of microphones is caricature of Joseph Goebbels

gear, he completes the body. When the 37-mm. projectile is held with its nose downward, its base resembles the hair-do popular among some African women. A few wads of modeling clay, a little work with a dental tool, and the shell has acquired temporary eyes, nose and mouth. More clay is used to hold the nose of the shell in the end of the tubing and to secure the two cartridge cases to the body.

The mockup now is complete, and can be examined for possible ways to improve it.

Odd pieces from scrap box present dramatic scene of Red Cross stretcher-bearer group. Right, assembling queer African idol





This is Dr. Cooper's self portrait which amuses his visitors. Below, sailors ride waves of lathe chips



The hole in the base of the cannon shell suggested a candle socket, so Dr. Cooper plans to assemble two such figures to make a pair of candle sticks. After he is satisfied with such a mockup, he proceeds with final assembly. This consists mostly of replacing the modeling clay with permanent materials. By pushing a scribe through the center of each eye, he marks the points where holes are to be drilled and tapped to receive bolts whose heads will become the permanent eyes. In a similar way he marks the positions of mouth, ears and nose. Bolts, solder and rivets are used to fasten together the various parts of the figure.

This is essentially how junketeering is done. The craftsman simply assembles various items to resemble a face, figure, animal or other object. Often the result is amusing as well as artistic; sometimes the theme is sobering. Individual figures can be assembled into groups to tell a story, examples being Dr. Cooper's Coastguard boat, Red Cross stretcher-bearer group and model circus.

Much of the fun results from discovering how a certain piece may become an eye, ear or other bit of anatomy. Dr. Cooper and the Jencso brothers are continually finding new ways of using odd bits and pieces. They have a few "standard" practices, such as using boltheads for eyes, that anyone can employ. The slots can be positioned to suggest normal or oriental eyes, or to give a drowsy expression to the face. Phillips-head bolts produce staring eyes. Larger boltheads, with the slots horizontal, make excellent mouths. Ears may be bolts with knurled heads, the ring ends of cotter pins, or screw eyes. Half-round threaded sections of bolts may be used as feet. Whole bolts become arms and legs. Screw eyes serve as oarlocks on row-boats, ears of figures and decorative trim around circus merry-go-rounds.

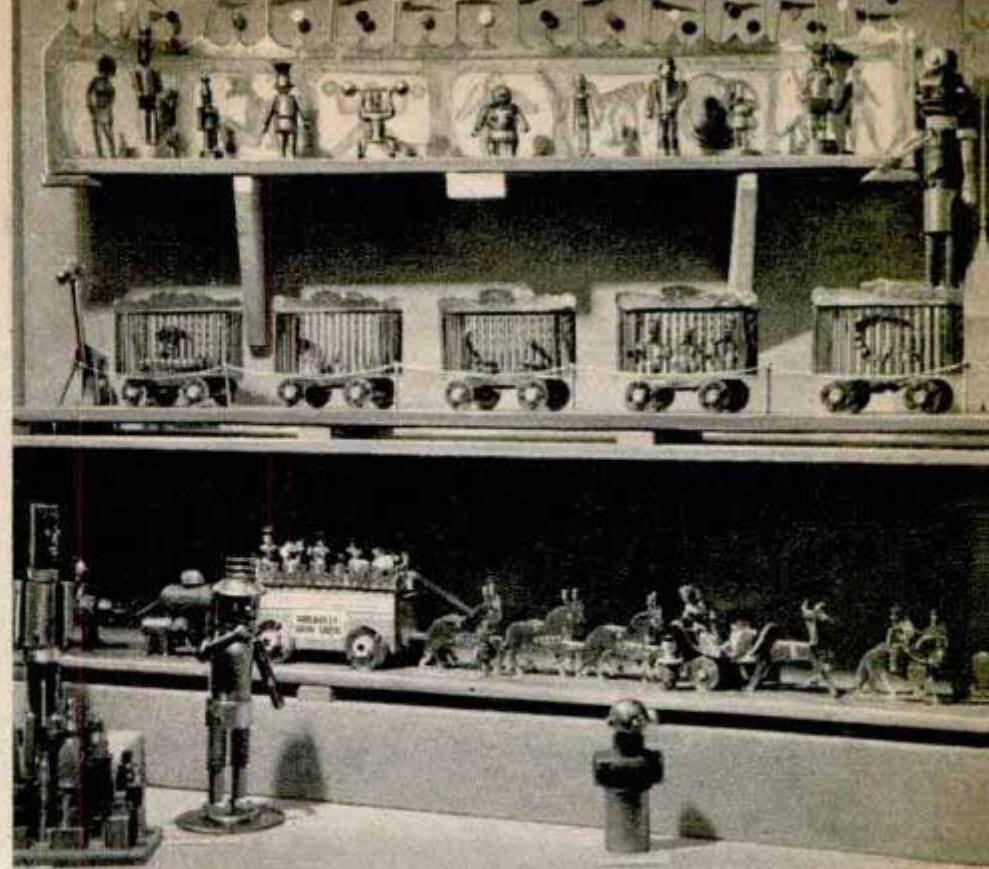
Heads of figurines may be anything round or cylindrical—cannon shells, large

iron balls, drawer pulls. In general, Dr. Cooper tries to keep his figures on a scale of one half inch to the foot. Sometimes, when he cannot find the right shape in the junk collection, he resorts to filing and other forming operations. But most of the fun of the pastime is the combining of ready-made shapes. It is not necessary to reproduce all the details of the figure to be represented. Often a mere suggestion is enough. Thus, in a group of sailors in a boat, the men have no ears, yet this omission is seldom noticed.

Lathe chips, particularly the long, coil-spring type, have many uses. Dr. Cooper stretches them in wire frames, paints them appropriate colors, and produces realistic United States flags. Flat, broken chips produced by heavy cuts make excellent waves for an ocean scene. Curly chips may be used for the hair of certain types of damsels or become the elements of a grass skirt.

One of the most successful model groups produced by Dr. Cooper and Steve and George Jencso is a miniature circus that includes a parade procession and complete sideshow. There are elephants made from pipe fittings, bolts and iron balls once used in coal crushers. Horses pulling the band-wagon were made by assembling flat sections sawed from heavy sheet brass. The main part of a lion is a copper thermostat bellows. An open coil spring forms the body of the human skeleton. Inside the circus cages are various rare and wholly imaginary animals, including vicious-looking reptiles having lathe-chip bodies and hexagon-nut heads. This circus, together with some grotesque fetishes, graceful candlesticks, and other examples of the junketeer's art, won an armful of prizes at the 1945 May Show at the Cleveland Museum of Art. Dr. Cooper intends to present the circus to the museum for permanent display, but first he is scheduled to exhibit it at various hospitals, along with other models.

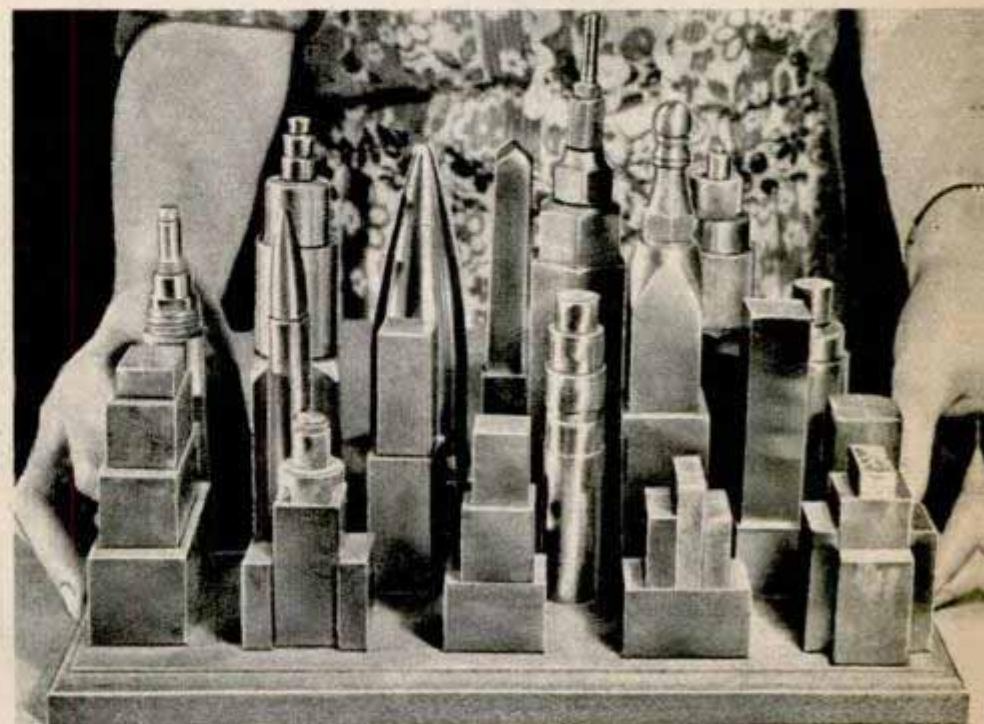
The possibilities of the new hobby in hastening recuperation among hospital patients are so promising that Dr.

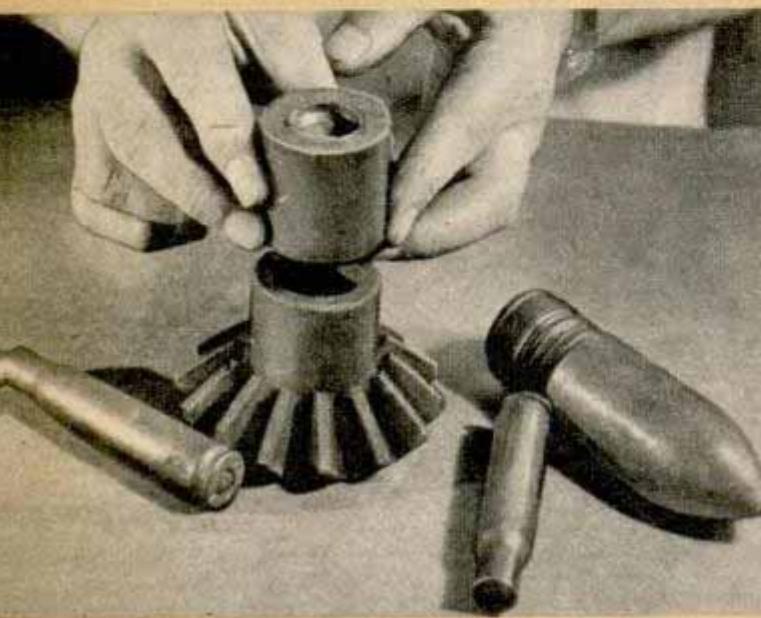


Ingenious scrap metal circus includes wagon train with caged animals and sideshow. It was exhibited at Cleveland Museum of Art

Cooper hopes to devote his full time eventually to the teaching of such occupational therapy. So simple and easily obtained are the materials and equipment needed that the hobby can be pursued in almost any hospital. He expects to see this done on a nationwide scale among civilian institutions. Officials of military hospitals are studying the possibilities. Not long ago the Russian government heard about Dr. Cooper's work and requested some models. He has sent 35 items to Moscow, and has more in preparation. He has been informed that the project is being adopted in Russia.

"Big City" is made of steel blocks, cartridge, brass pieces and nuts





Series from top to bottom shows how to make native figure at right. Sloping teeth of old bevel gear form skirt and steel tube completes torso. Other parts are cannon projectile and cartridges

hospitals. The various standard hobbies, employed widely to occupy the minds and hands of patients, do not always stir their imagination, and sometimes lack masculine dignity. A man patient may benefit greatly from knitting or crocheting, but he is reluctant to show his work to others. But Dr. Cooper has found his model-building to be sufficiently mechanical and virile to satisfy any masculine standard. So, before long, instead of taking flowers to a hospital patient you may make him happier by taking a bagful of assorted bolts and nuts.

The assembling of scrap box parts into models is an excellent way to develop mechanical skill and steadiness of eye, nerve and muscle, as well as imagination. Dr. Cooper expects junketeering to be adopted as a school activity, perhaps in connection with art and vocational education courses. Here, again, availability of materials and simplicity of equipment are important.

Dr. Cooper and his two associate craftsmen have refused to capitalize on their hobby. They will accept donations of scrap parts, but no money. They feel that they have been amply rewarded in the fun they have had and in the making of life easier for hospital patients and others.

So if you want to assemble the sweepings from a machine-shop floor into a figure of Paul Revere, go right ahead; you have Dr. Cooper's blessing and his hope that you will become a confirmed junketeer.

"How old do you think I am?" Dr. Cooper asked as he worked on a display he is building to show life in the Gay Nineties.

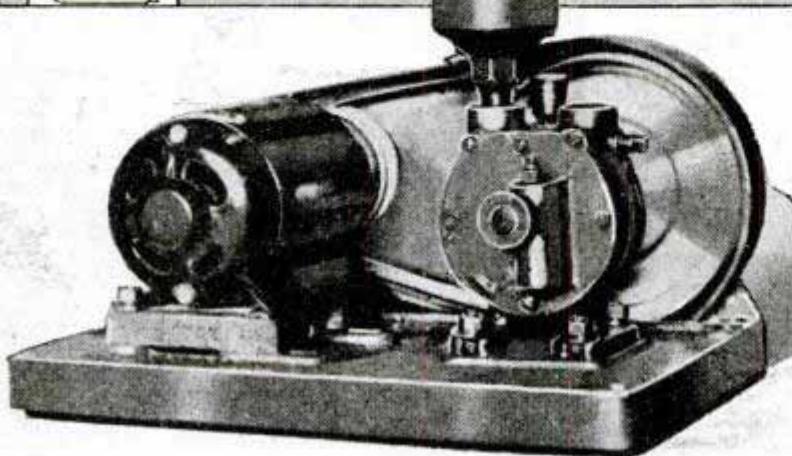
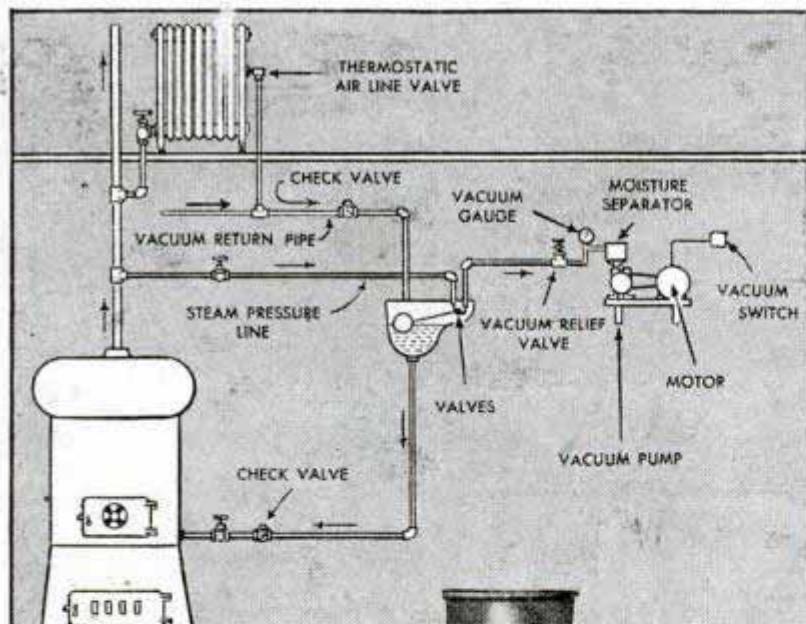
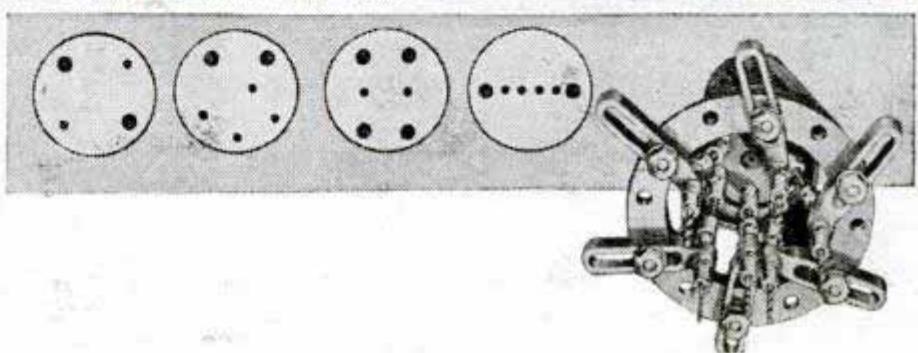
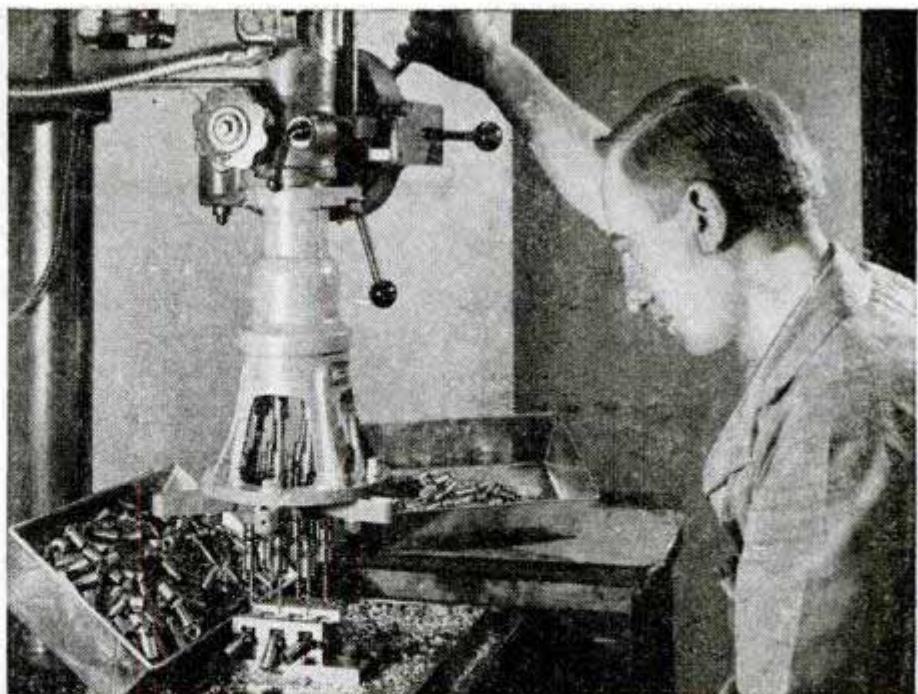
"Oh, in the forties somewhere."

"I'm 57," he said, laughing. "When people say I don't look my age, I tell them it's because I always have had some creative hobby to occupy my spare time. And of all the hobbies I've tried, I think this one is the most interesting."



Adjustable Drill Follows Pattern

Six holes can be drilled in any pattern by a universally adjustable, multiple drilling attachment which can be installed on most types of drill presses. It consists of a driving head with six movable spindles, each located by an individual radially adjustable arm. The attachment permits the positioning of drills up to $1\frac{1}{64}$ inch diameter in any hole pattern, including a straight line, within a five-inch diameter circle with minimum distance of $1\frac{1}{16}$ inch between centers. The housing for drive gears and the supporting frame and adapters are made of strong aluminum alloy. The attachment weighs 13 pounds. It can be installed on most types of drill presses.

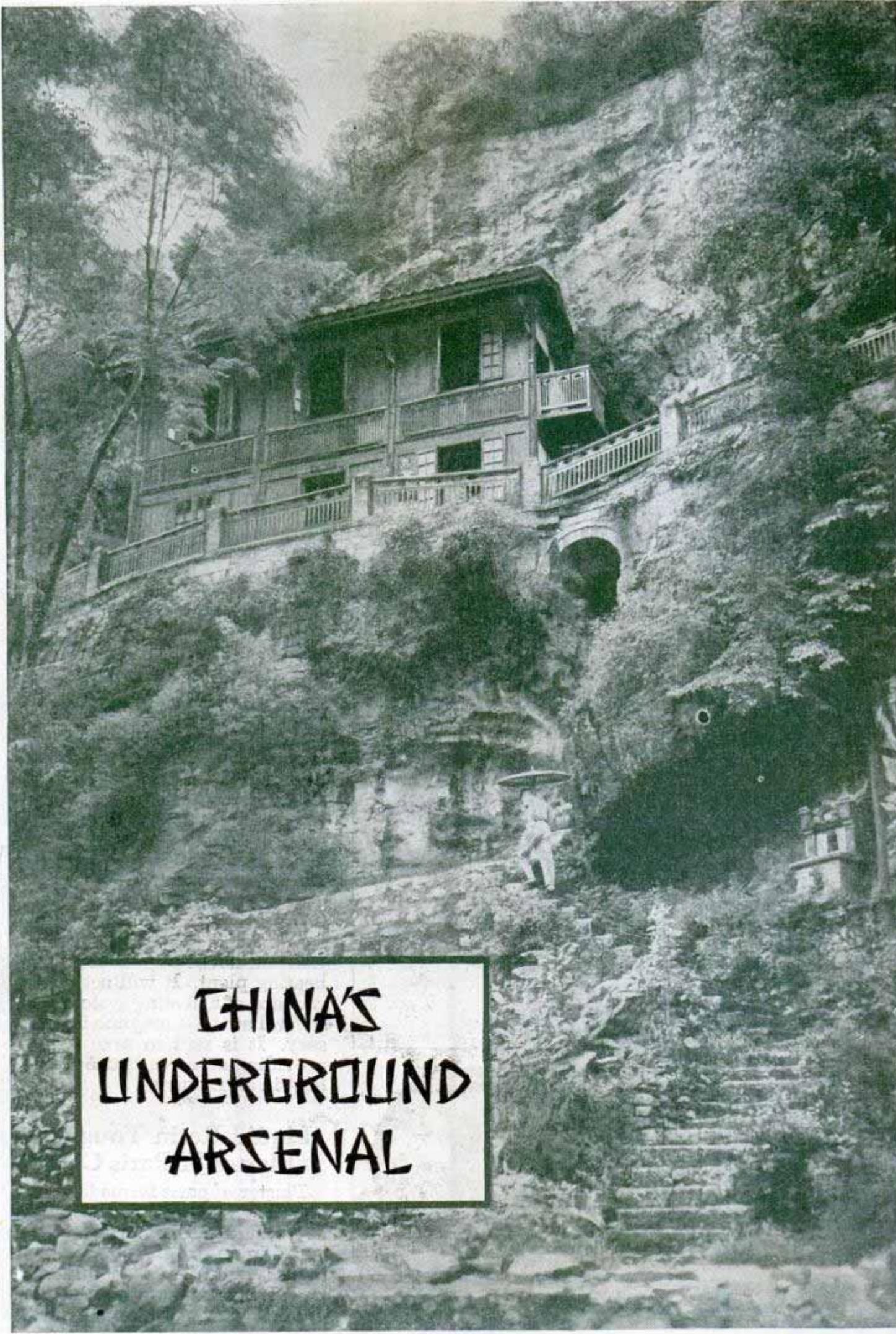


Vacuum "Spurs" Radiator To Give Even Heat

Acting as a kind of troubleshooter, an automatic vacuum unit is designed to operate only when a steam radiator stops giving heat. The unit stands by idly until a radiator fails to get its share of steam or starts acting up. As soon as the vacuum gets the radiator working again, it returns to inactive duty. The unit is simple in construction and operation and can be fitted to any steam heating plant. It will act on any radiator of a heating system or on several at the same time if necessary. It is said to save fuel by providing an even distribution of heat in all radiators.

Liquid Resin Toughens Plaster of Paris Casts

Plaster of paris forms take on a bonelike hardness when dipped in a liquid resin impregnant and cured in an oven. The treatment makes figurines, dies and core boxes more resistant to high temperatures, water and chemicals.



CHINA'S UNDERGROUND ARSENAL

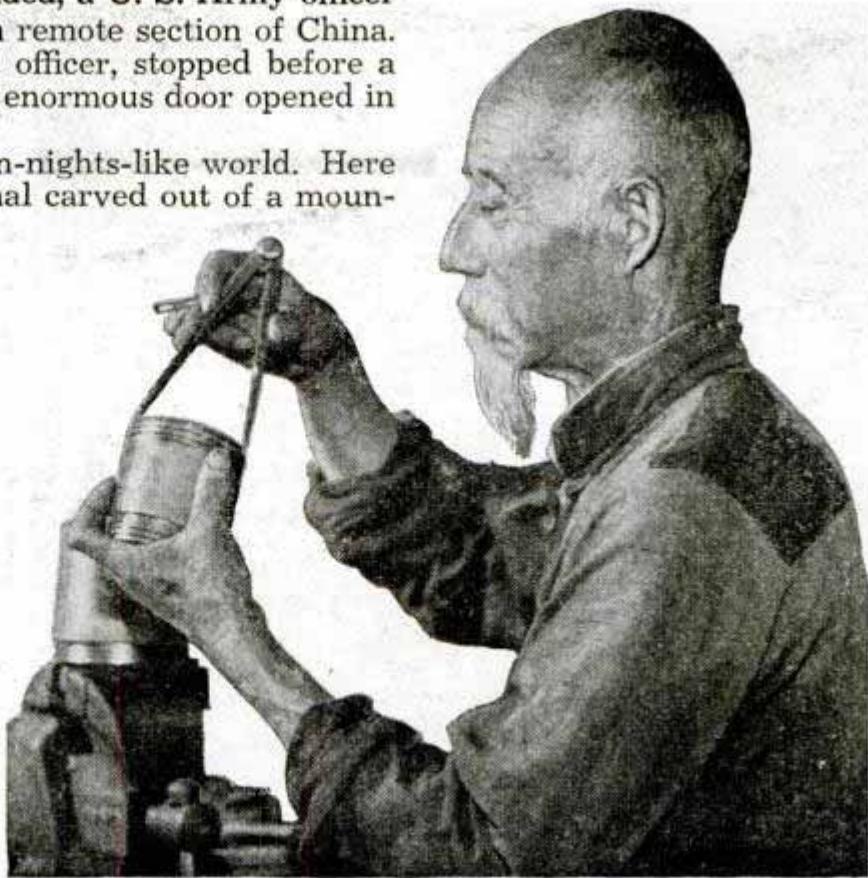
SHORTLY before the war ended, a U. S. Army officer was on a secret mission in a remote section of China. Suddenly his guide, a Chinese officer, stopped before a hill and clapped his hands. An enormous door opened in the side of the hill.

Inside they found an Arabian-nights-like world. Here was a huge underground arsenal carved out of a mountain of rock. In the blacksmith shop, workers labored with cold chisels forged out of the finest medium carbon steel. Not far away another group of special workers could be seen removing red-hot steel bars from annealing ovens. Later the bars were put in hydraulic presses and made into projectiles for 75-millimeter ammunition.

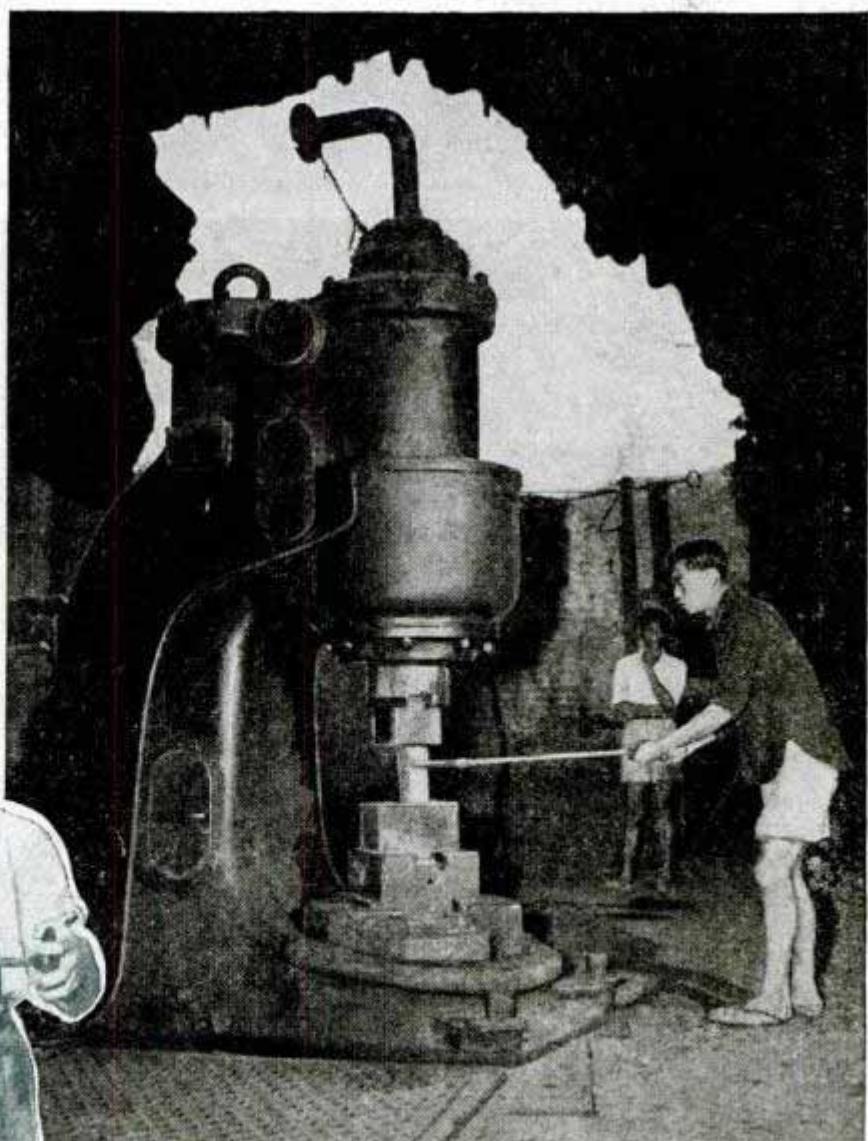
The guide explained there were about a dozen of these underground arsenals in China located at strategic points close to the major battle zones. Each cave contained many large shops and a Diesel-electric generator to supply power for machines.

Each secret arsenal had its own plants for making most of the shells, machine guns and basic weapons. Both American-style bullets and projectiles and Chinese "ammo" were manufactured and loaded. Of special help were machines that crimped the bullets to the cartridges. This type of machine, like many other pieces of arsenal equipment, was of German manufacture—acquired legitimately or otherwise. All manner

Below, testing machine gun in underground arsenal where it was made



Aged Chinese craftsman checks a bushing for lathe in tool making shop of cave arsenal. Below, making 75-mm. "ammo" from hot steel





Left, GIs watch Chinese worker check bolt of machine gun. Right, loading steel bar into hydraulic press

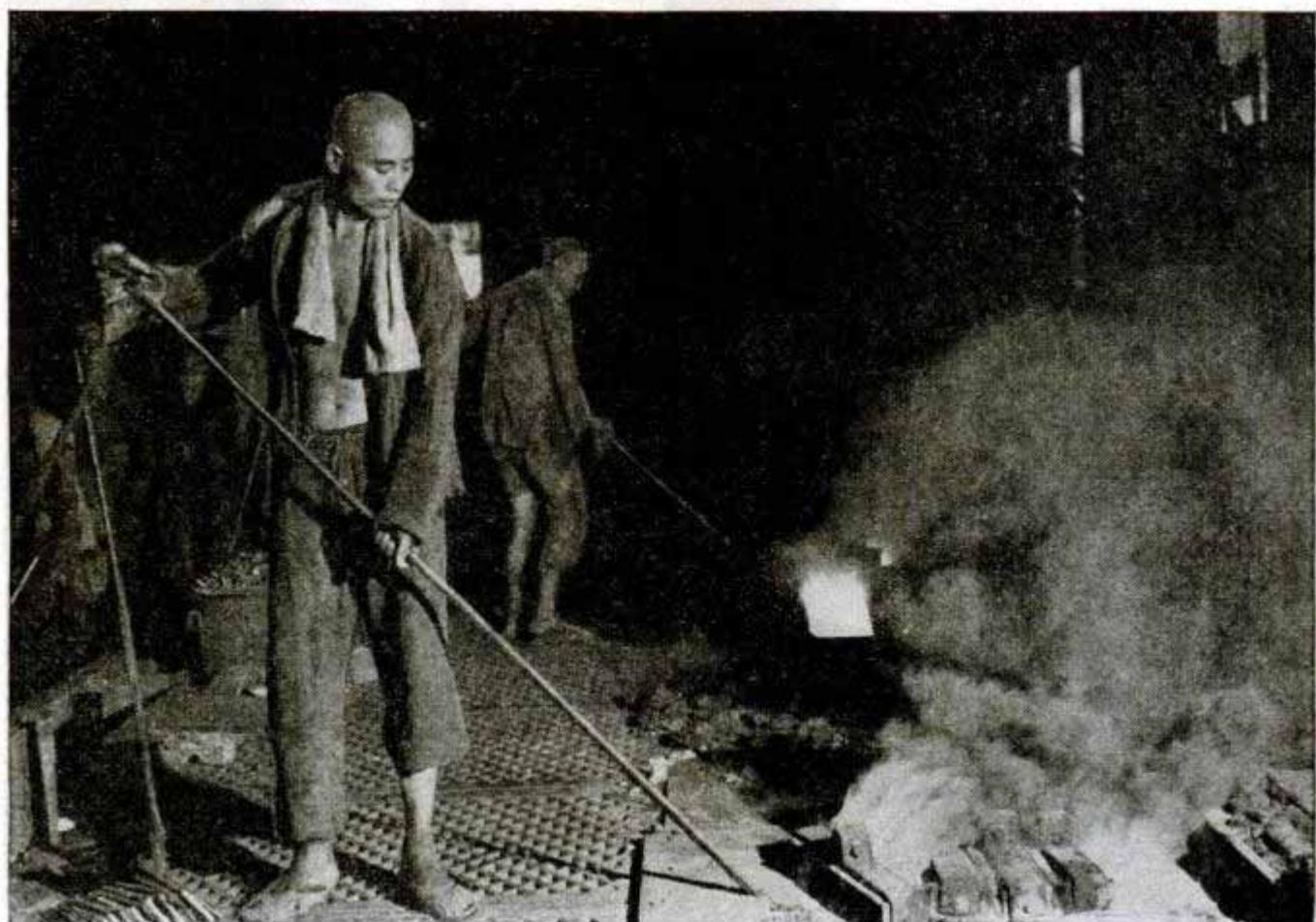
of steel projectiles were made in the cave arsenals, although emphasis was on the 75-millimeter projectile, often hailed as the No. 1 weapon in the Sino-Jap war.

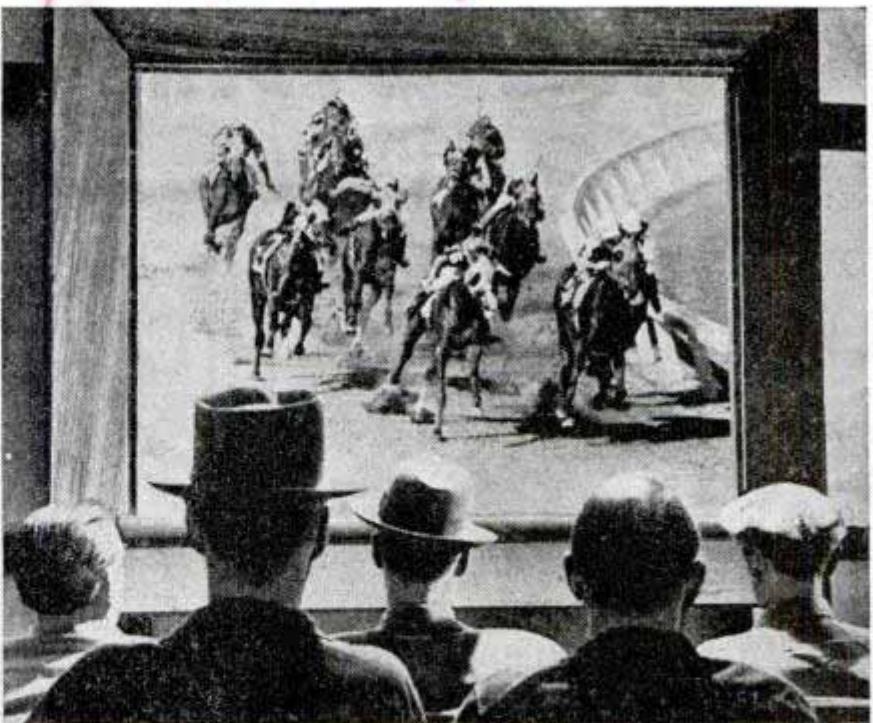
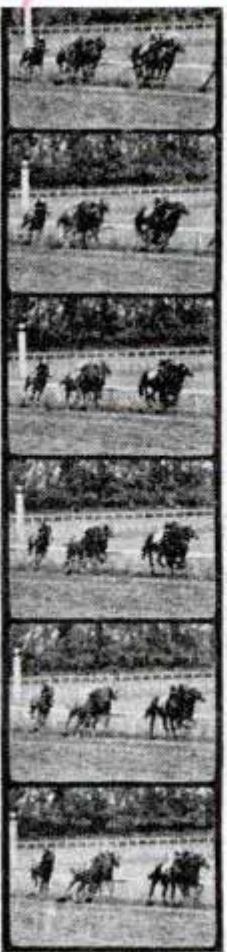
Chinese of all ages worked in the arsenals. They operated bandsaws used to cut wood for hand grenade boxes, packaged ammunition, and cast molten brass

into molds. Crucibles were made of rock cut by hand. All metal shavings were melted down and used again. The rolling mills made steel bars into six-foot lengths. Then they were cast into slugs and pounded into cartridges.

These hidden arsenals were China's bulwark in the dark days before victory.

In foundry at hidden arsenal deep in China, workmen prepare to melt brass in one of the many furnaces





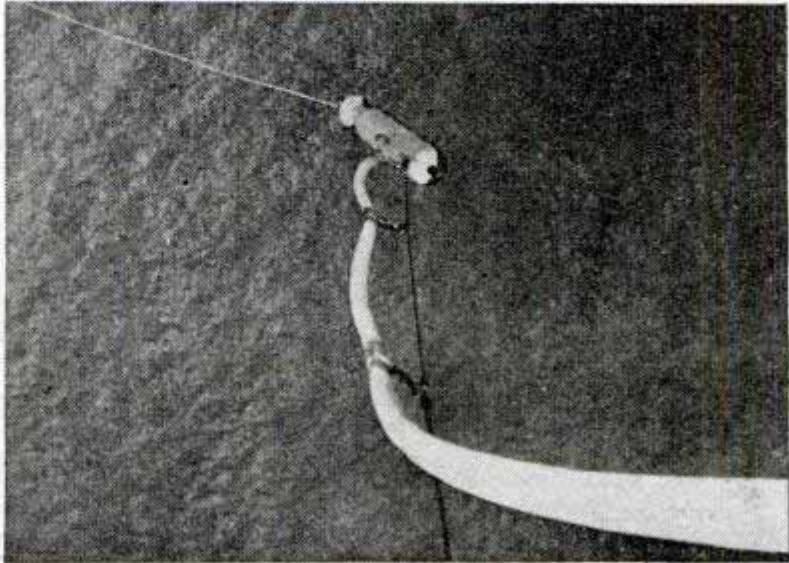
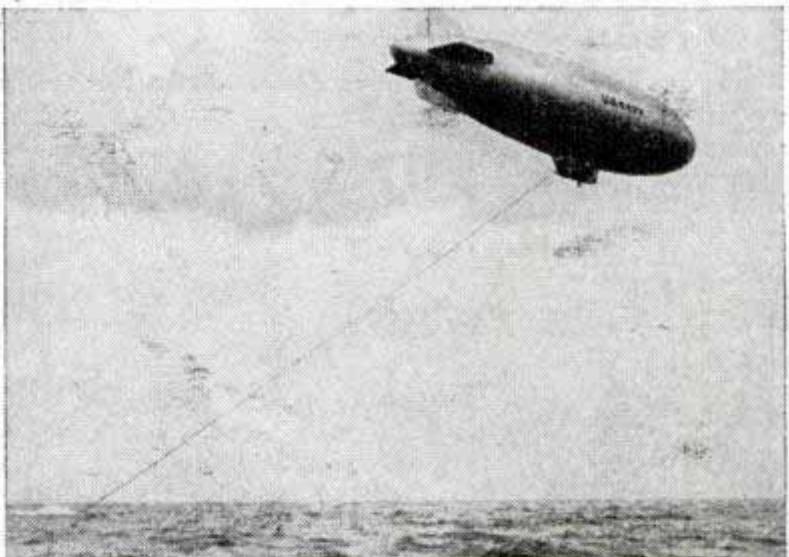
TELEPHOTO CAMERA at a California racetrack goes a step farther than the photo finish and provides a complete motion picture record of every foot of the race. The 16-millimeter camera is mounted on a 40-foot tower. Seven minutes after the race the movie can be run off for the benefit of stewards and judges. It insures accurate decisions on foul claims or any questionable action on the part of a jockey

Metal "Fish" Scoops Water For Navy Blimp Ballast

Towed by a blimp flying just above the surface of water, a torpedolike scoop is being tried out by the Navy to pick up water ballast. All lighter-than-air craft lose weight as they consume fuel, and various methods have been developed to counterbalance this loss. In the Navy's latest tests in Lake Erie a small electric pump was placed in a fishlike container with an opening at one end. The metal "fish" was towed behind a low-flying blimp to scoop up water that was pumped through the hose towline to the airship. The towline also served as a conduit for the electric wires that supplied power for the motor-driven pump.

Plastic Treatment Hardens Wood

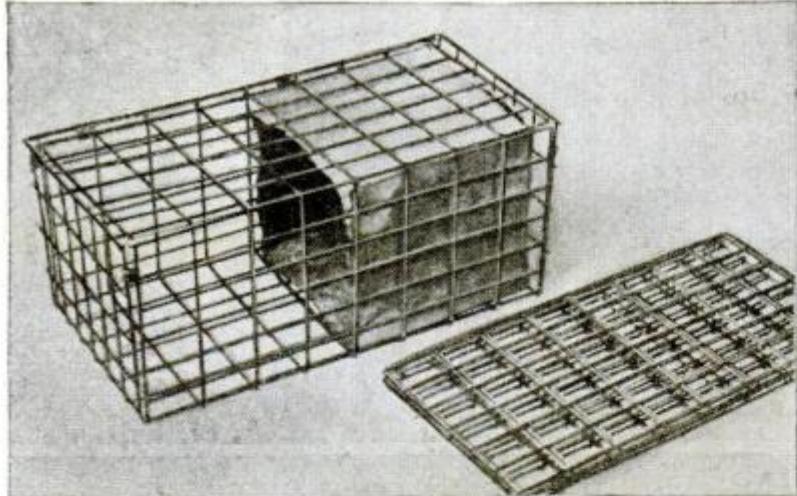
Wood impregnated with a plastic called Asidbar has increased weight and hardness, greater resistance against abrasion, water, chemicals and acid fumes, and acquires a black finish that need not be painted. The treated wood is suitable for flooring on platforms, in railroad cars and in structures subject to rough use.



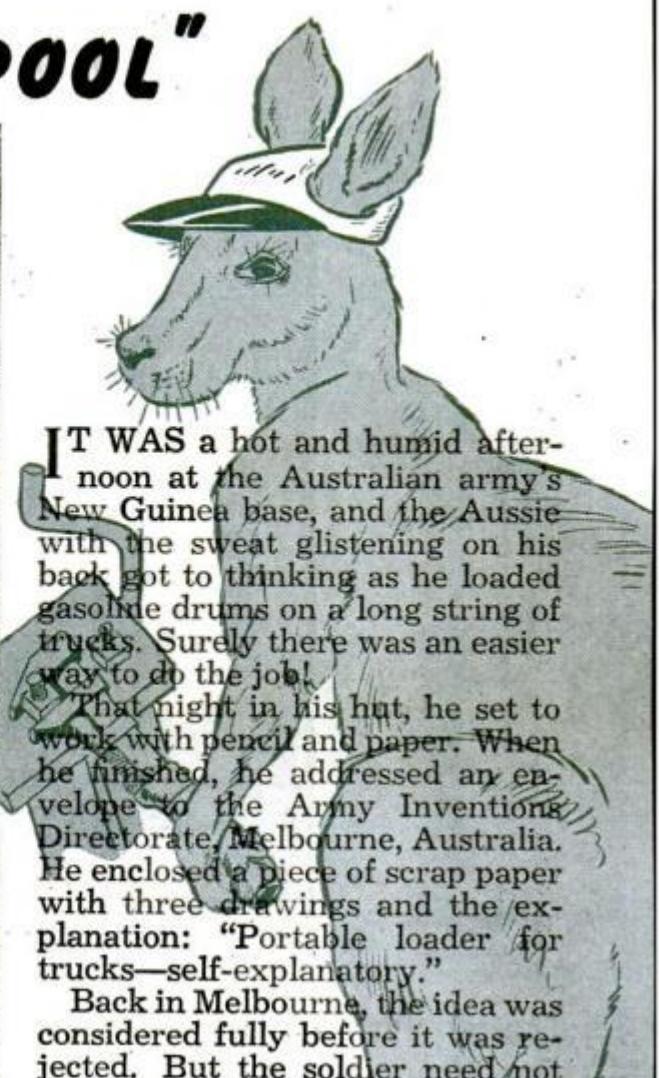
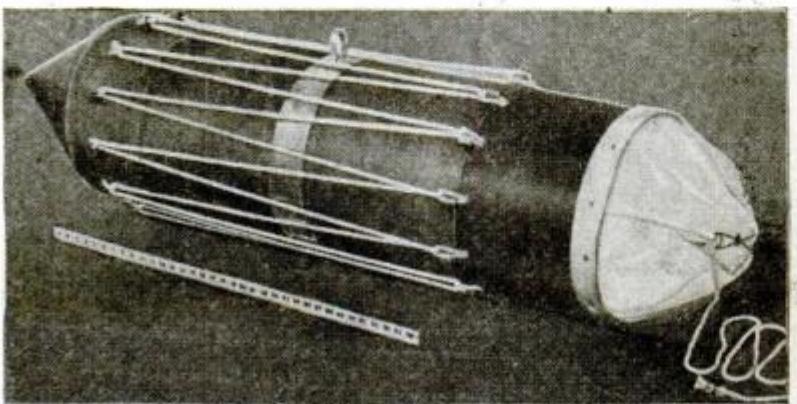
AUSSIE "G/IDEA POOL"



Auger attached to tractor gearbox digs postholes for Aussies



Among ideas offered to the Australian Army Inventions Directorate were the collapsible package container, above, and the "Storpedo," below, shockproof carrier for parachuting supplies



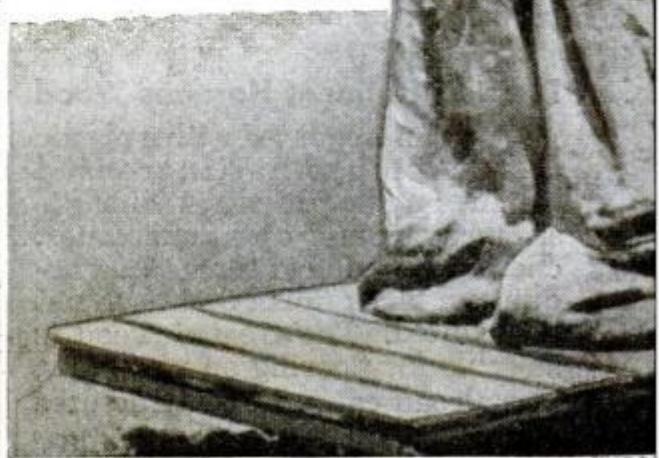
IT WAS a hot and humid afternoon at the Australian army's New Guinea base, and the Aussie with the sweat glistening on his back got to thinking as he loaded gasoline drums on a long string of trucks. Surely there was an easier way to do the job!

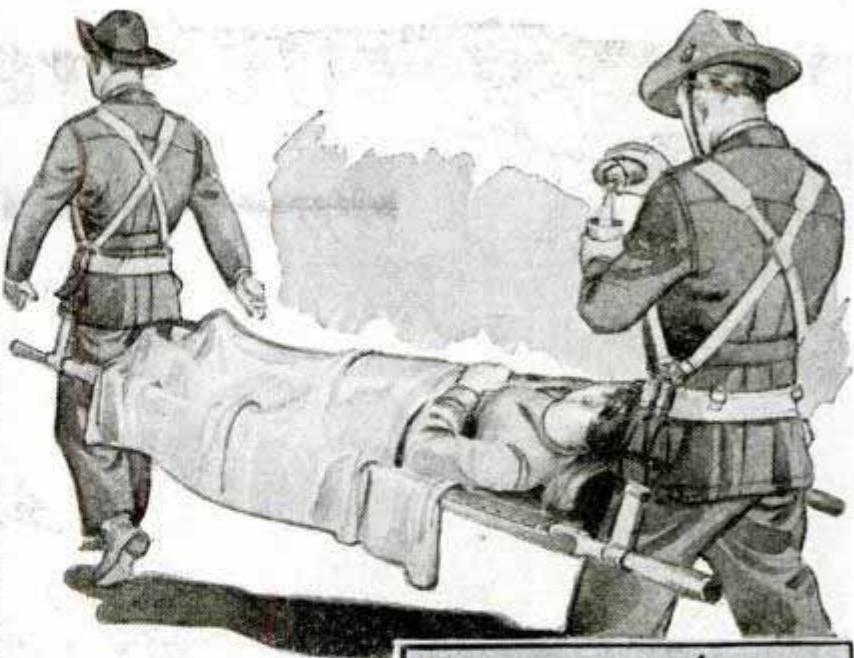
That night in his hut, he set to work with pencil and paper. When he finished, he addressed an envelope to the Army Inventions Directorate, Melbourne, Australia. He enclosed a piece of scrap paper with three drawings and the explanation: "Portable loader for trucks—self-explanatory."

Back in Melbourne, the idea was considered fully before it was rejected. But the soldier need not feel bad about it because the army probably had his idea in mind when it developed its skid-loader which now is in wide use.

Since the Inventions Directorate began in March 1942, more than 20,000 submissions have poured in from servicemen at the front lines and in barracks, from bank clerks and grocer's assistants.

Necessity is said to be the mother of invention and the Australians seem to have a flair for figuring out an easy



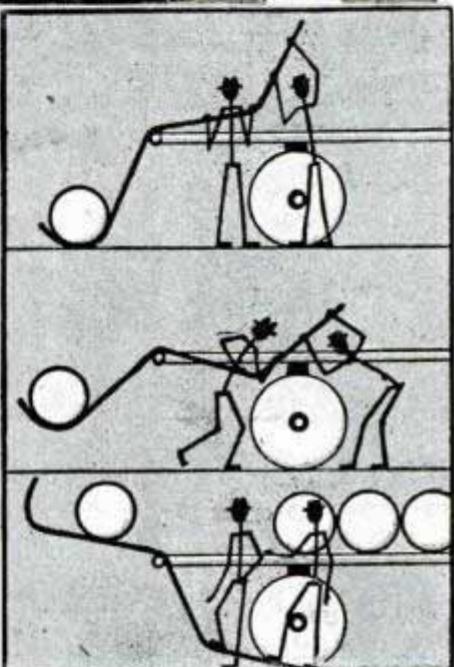


Stretcher bearer's harness leaves both hands free for climbing or clearing trail

way to do things. Take the stretcher bearer's harness which was developed during fighting in New Guinea. Soldiers, with heavy packs on their backs, found it tough enough to push their way through the tangled jungle growth in their chase after the Japanese. But stretcher bearers carrying the wounded out found the going almost impossible. They could not free a hand to push the vines and branches aside. That's how the harness was invented. Now the stretcher poles are inserted in loops in a harness hanging from the medical aid's shoulders. Both his hands are free.

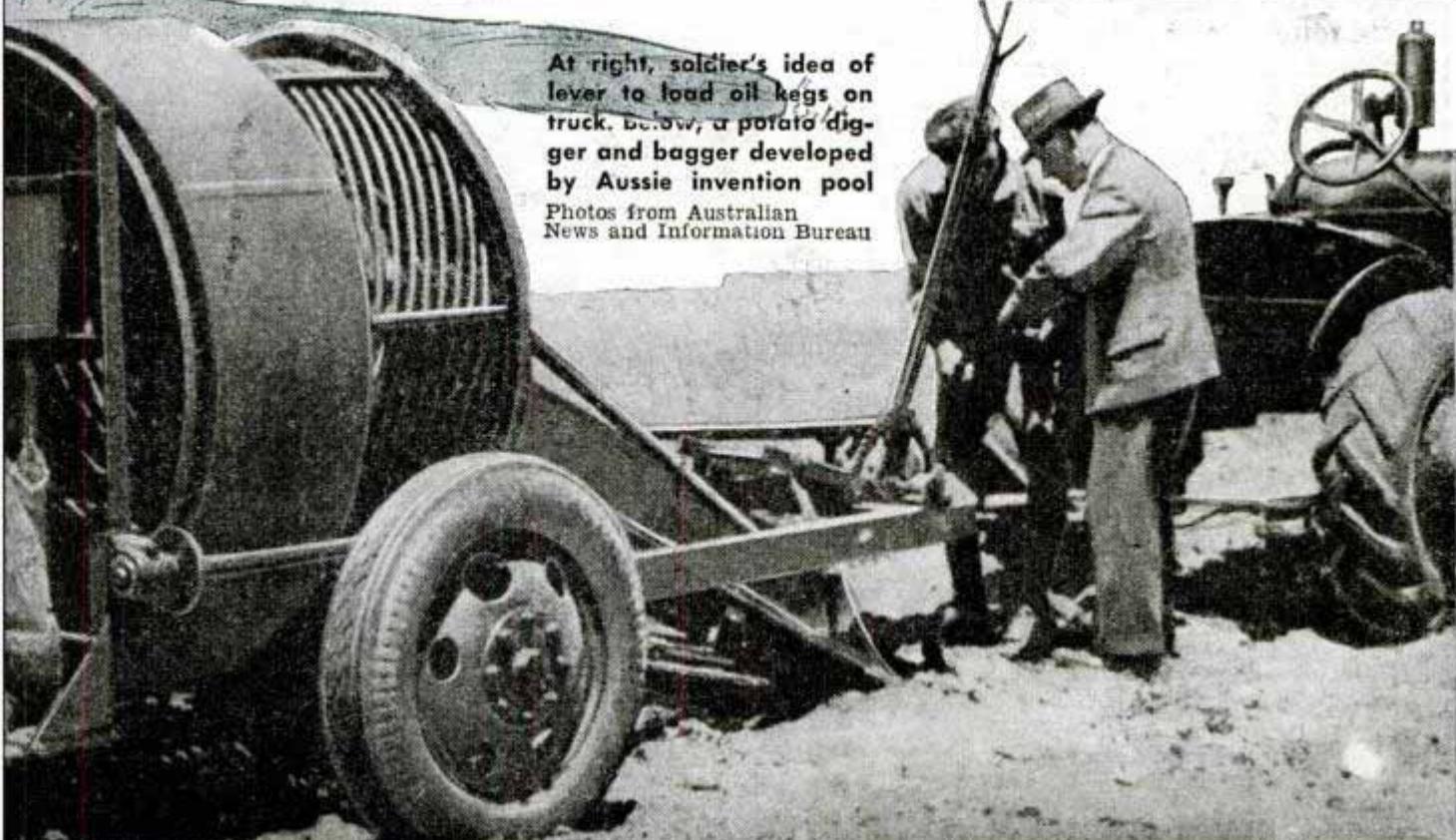
An Australian sergeant noticed scraps of steel mesh

(Continued to page 148)



At right, soldier's idea of lever to load oil kegs on truck. Below, a potato digger and bagger developed by Aussie invention pool

Photos from Australian News and Information Bureau





Shutters in Glass Window Open Like Venetian Blind

Windows resembling Venetian blinds, with louvers of plate glass that open horizontally for maximum ventilation, have been designed for postwar homes. When horizontal, the louvers open 90 percent of the window area for maximum ventilation. They can be tilted to any position to provide the desired ventilation while preventing draft. When closed the louvers overlap slightly, creating a watertight seal. The window is manufactured complete, ready to install in place of the usual sash. The louvers are available for both windows and doors and are made up in frosted glass for bathrooms, in tinted shades, and half clear, half frosted decorative designs.

The housewife is often the "popular mechanic" of the home—electrician, carpenter, photographer, plasterer in emergencies. Now that the postwar markets are brightening up with new appliances, the mechanics of running the household are a little less arduous. Keep abreast of what's new for the home by writing for information to the firms listed in the Where-to-Buy-It Index on page 8A, and say you saw it in Popular Mechanics.

Handle Feeds Cleaner Into Brush

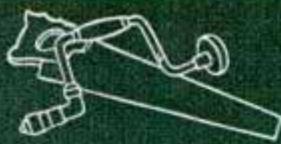
A combination shoebrush and bottle of cleaner now on the market makes that last-minute touch-up of your shoes the work of a moment. The brush cleans suede, fabric and buckskin shoes, and the handle acts as an attached dispensing bottle that feeds a cleaning fluid into the brush for removing spots and stains from kid and other smooth-finish shoes. A fingertip button on top of the brush controls the fluid, and the bottle handle is refillable.



Indoor Drier Fastens to the Wall



Ninety feet of drying space is provided by an adjustable indoor clothes drier that will hold more than 100 pounds of wet wash. Fastened to the wall by four hooks, the drier is out of the way when not in use. It is adjustable for one piece or an entire washing and has a suspension of 18 feet. Clothes hang over 24 adjustable wooden bars, without use of clothespins. When packed, the device measures 3 by 30 inches.



The Craftsman

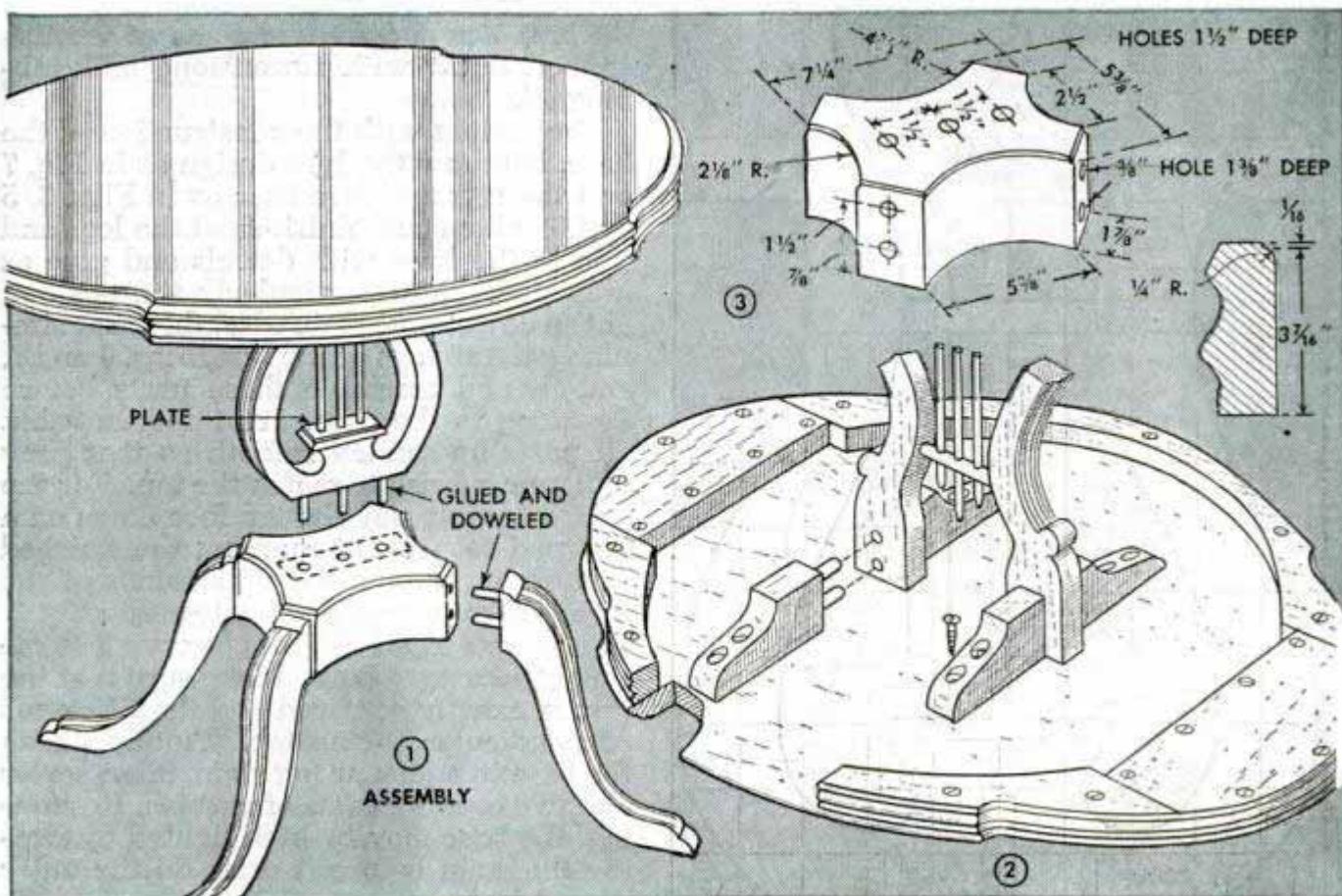


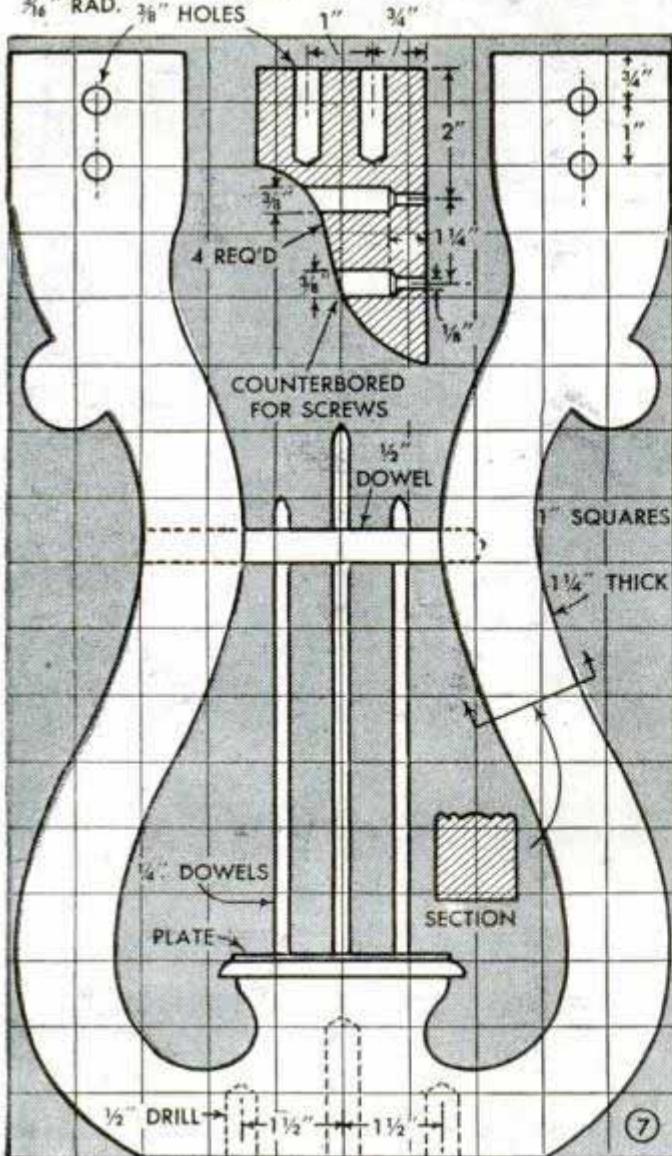
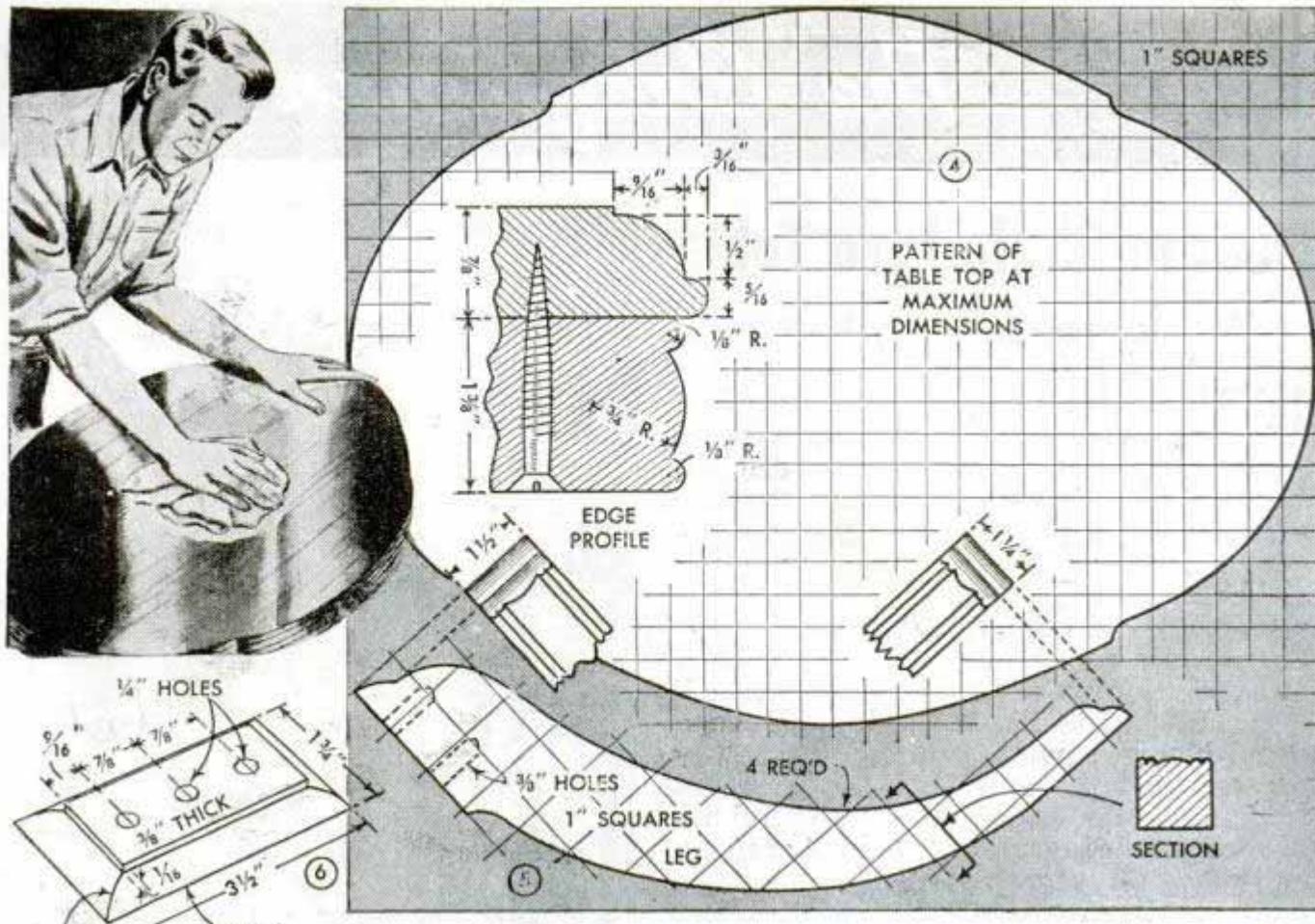
Duncan Phyfe Lyre Table

By Norbert Engels

BUILT of solid mahogany with a matched grain, veneered top, this attractive occasional table is fashioned from an original designed by a famous craftsman. Distinctive features are the oval design of the top with offsets and the adaptation of the lyre as a basis for the pedestal construction.

Figs. 1, 2 and 4 detail the top. Because of the exposed edges, solid mahogany is used as a core under the four-way matched veneer. Edge-glue flat stock to produce a panel having a width and length slightly greater than the finished size. Then cut four pieces of mahogany veneer, preferably of the quality known as "ribbon" grained, and plane the edges true by clamping the pieces between two strips of waste stock. Make a trial fit of the four pieces to be sure the joints are tight, then join the four pieces with tape so that the grain matches in a diamond pattern. Finally glue the veneer to the mahogany core. After the glue is thoroughly dry, bandsaw the top to the pattern in Fig. 4 and run the molding on a



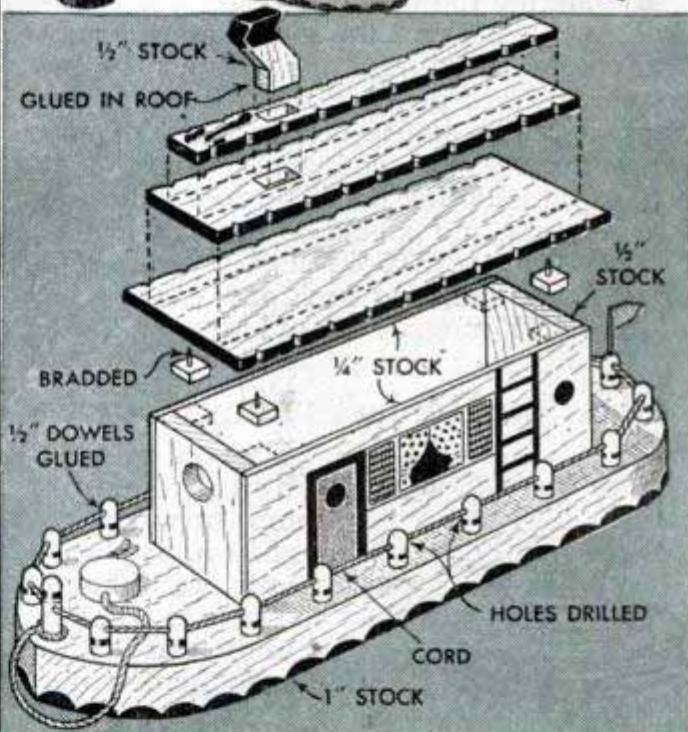
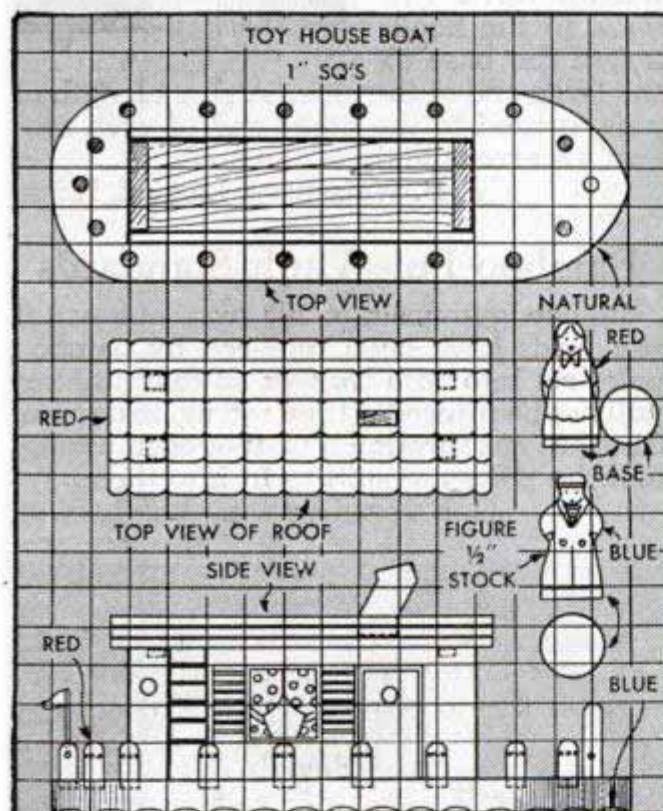


shaper. Next build up the apron as in Fig. 2, shaping the edges as in the sectional view, Fig. 4. Note that the top overhangs the apron slightly as in Figs. 2 and 4, and that it is bandsawed to the same pattern and glued and screwed to the underside of the top. Finish the top in the regular way by sanding smooth and applying stain, filler, sealer and several coats of varnish rubbed down with rottenstone and rubbing oil.

Proceeding with the construction of the base, bandsaw the lyre design as in Fig. 7 and the legs and lyre base as in Figs. 3, 5 and 6. Shape and finish-sand the legs and join to the base with dowels and glue as indicated. Note particularly the position of the dowel-and-plate assembly that simulates the strings of the lyre, Figs. 6 and 7, and fit and assemble these parts before doweling to the base. It's important that all parts be sanded smooth so that they will take a finish to match the top. For the final assembly, lay the top face down on a soft pad to prevent marring the finished surface and attach the upper ends of the lyre to the underside of the top as in Fig. 2. To assure a rigid assembly very close fitting is necessary here. Make sure that the lyre is exactly centered and that it stands perpendicular to the top. Finally, finish the base to match, using stain, filler, sealer and two or more coats of varnish. In staining, the base may be highlighted by wiping the stain before it dries on the outer exposed edges.

This Toy Houseboat Will Amuse Young Sailors

Designed for very young tots, this toy houseboat is simple in construction yet sturdy enough to stand the hard use it will receive. Because it has a removable roof, the boat can be used to store other small playthings besides being a toy itself. The deck is cut to the shape shown, and $\frac{1}{2}$ -in. holes $\frac{1}{4}$ in. deep are drilled for all dowel posts, except the hole for the one in the bow which is cut all the way through. The bow post is 3 in. long and the others are $1\frac{1}{4}$ in. long; all are rounded at the top and have holes for the cord. When the sides and ends of the cabin have been sawed and portholes drilled in the ends, the structure is assembled and nailed to the deck. Built of three sections, the roof is bradded together and the chimney is glued



in the hole provided for it. There are four stops on the underside of the roof to hold it in place. For finish, the roof, chimney, railing posts and curtains are painted red and the outlines are black. To suggest waves, blue scallops are painted around

the bottom and the shutters also are blue. The suit and hat of the man are blue and the woman wears a red dress with a white apron. For the sake of simplicity, the rest of the boat is left in natural finish.

Roberta L. Fairall, La Crescenta, Calif.

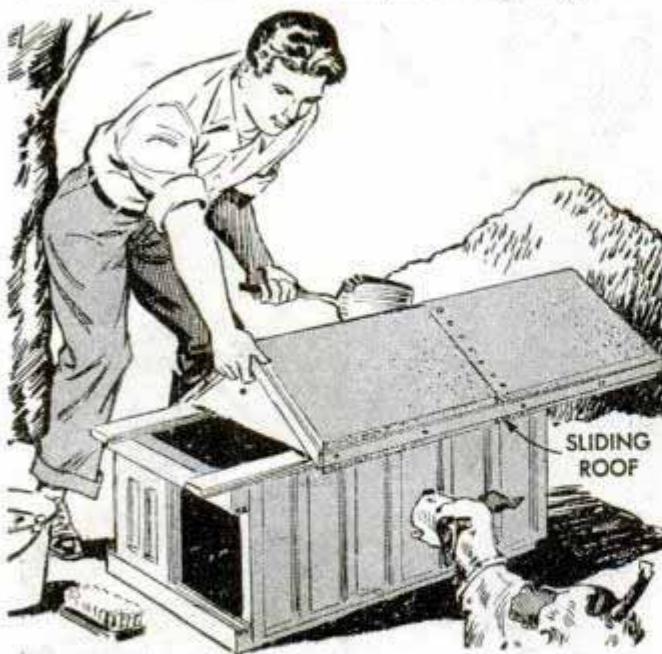
Abrasive Strips for Model Work Can Be Made From Cellulose Tape

Handy and efficient abrasive strips for finishing or touching up model parts can be made by sifting emery on the adhesive side of a strip of cellulose tape. Cut off a suitable length and fold over the end for finger grips. If an old salt or pepper shaker is available, it can be used to apply the emery uniformly. An abrasive wheel for a

small motor is made by turning a wooden wheel and attaching cellulose to it sticky side out. Abrasive then is sprinkled on the surface.—W. C. Wilhite, Carlinville, Ill.

Ordinary paper bags filled with shavings, sawdust or small scraps of wood make excellent fuel for starting a furnace fire.

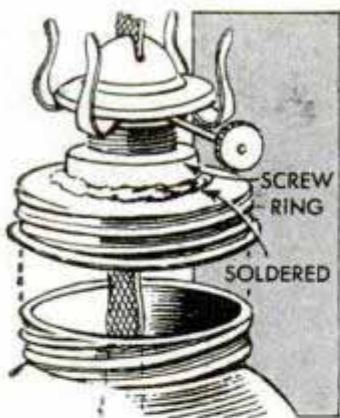
Dog House Has a Sliding Roof To Permit Easy Cleaning



By making the roof of a dog house movable, you can clean the house more easily and change bedding chips without the inconvenience of pushing them through the doorway. The house can be built of any scrap lumber, but redwood is best as it repels parasitic insects. The roof slides on two runners, and is held on them by cleats. For ventilation, a hole should be drilled through the gable at each end.

J. Martin Young, Jr., Santa Monica, Calif.

Glass Jar Replaces Lamp Bowl



drop down into the kerosene. For tall jars, a longer wick is required.

Jack Bronte, Grass Valley, Calif.

Testing Telescope Objective Lens

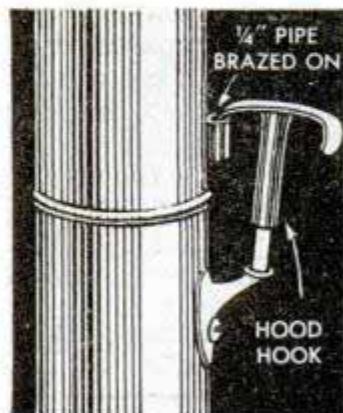
Sometimes when inspecting a telescope, binoculars, or other optical instruments, it is desirable to know whether the lens is a single one or the better grade cemented doublet. A simple test for this is to hold the instrument under an electric bulb so that the light shines on the lens. A plain piece of glass will show one large image

of the bulb; a single lens will show one large and one small image and a cemented doublet will show one large and two small images. Accuracy of the centering of a doublet can be noted by observing whether the three images form a straight line as the lens is manipulated under the light.

Hook Locks Grain-Blower Piping

Grain-blower pipe can be assembled easily and locked securely with the hook arrangement shown here. Hooks for this purpose can be obtained from a car or tractor. Using the fittings which held the hook to the hood, fasten the base to the large end of the pipe. A short length of pipe, brazed to the other end of each section, receives the tip of the hook.

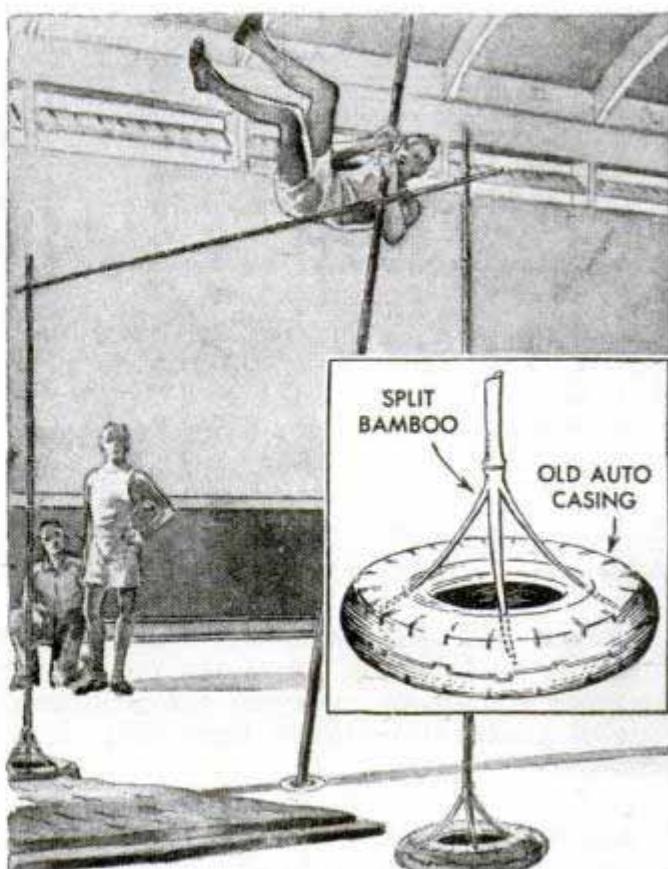
J. B. Weisensee, Larned, Kans.



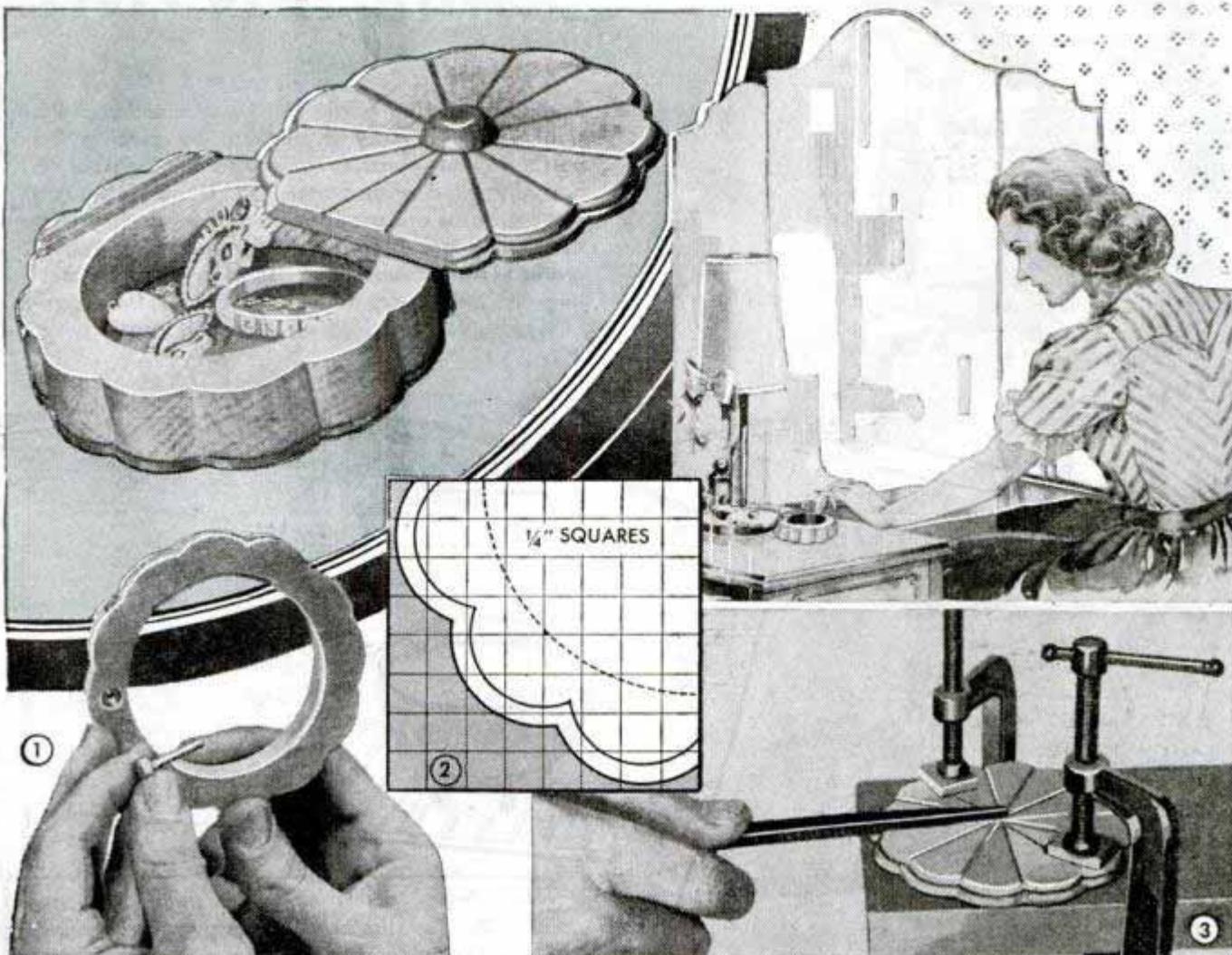
Bamboo Pole-Vault Standards

In one gymnasium, all iron pole-vault standards have been replaced by bamboo poles set into auto casings, so that athletes will not be injured if they fall against them. Slits are cut through a wall of each casing, and the poles are split to fit into them.

G. E. Hendrickson, Argyle, Wis.



Flower-Shaped Trinket Box Is Cut on Scrollsaw



Made from four pieces of scrap hardwood, this attractive trinket box provides suitable storage for costume jewelry. Two pieces of $\frac{1}{8}$ -in. stock are used for the top and bottom and a third piece is planed to $\frac{5}{8}$ -in. thickness for the body. The three pieces then are glued together, sandwich-fashion, with heavy paper in the joints so that they later can be separated. After scrollsawing to the scalloped outline, Fig. 2, the edges are sanded and the parts are separated by running a sharp knife around the joints. Then the circular opening is scrollsawed in the center piece, Figs. 1

and 2, and an overlay of $\frac{1}{8}$ -in. stock is cut to the pattern indicated and glued to the lid, Fig. 3. The latter is then grooved with shallow saw cuts which are widened to V-cuts with a three-cornered file. As will be seen, the lid, or cover, is pivoted on a pin made from a short length of dowel, the pin being glued in a hole drilled in the lid, but turning freely in a counterbore through the body. After assembling the box by gluing on the bottom, a small section of the lid is cut away and glued to the body to act as a stop. Lastly, glue a screw-hole "button" to the center of the cover.

Mucilage Applied to Scrapbook Clippings Through Spout of Oilcan

Mucilage can be applied easily and neatly through an oilcan spout along the edges of clippings that are to be entered in a scrapbook. This method prevents smearing the work table and eliminates the need of backing paper under the clippings to catch excess mucilage. When not in use, the oilcan spout should be kept tightly covered with a cork to prevent hardening of the mucilage.

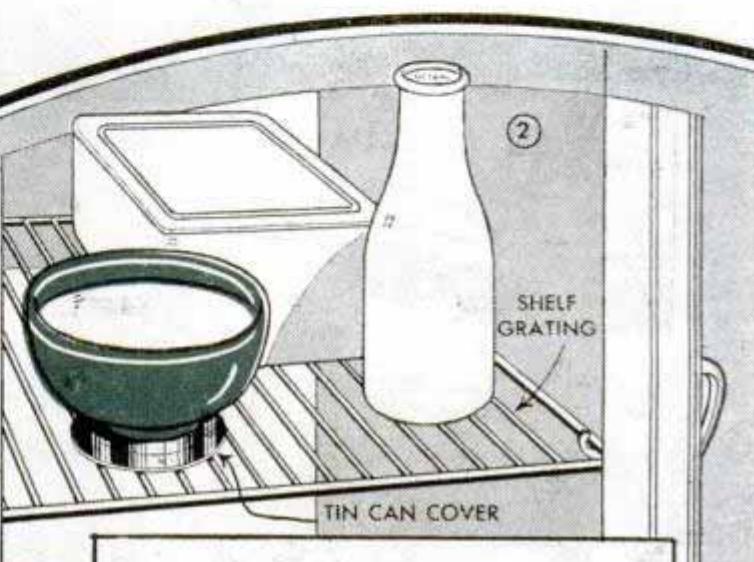
Pieces cut from old felt hats provide good inner soles for house slippers.



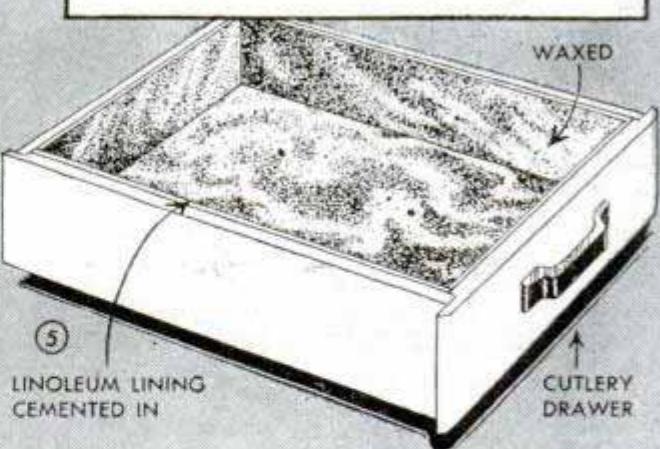
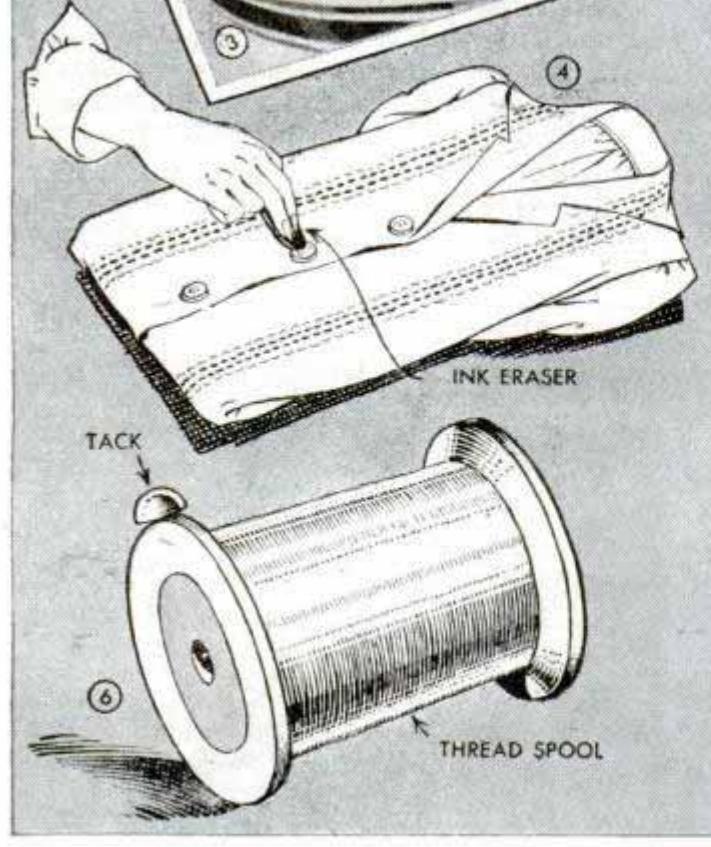
Solving HOME



1. Baby's nursing bottle can be warmed rapidly, right in the nursery if desired, by placing the bottle in an electric coffee percolator that is partially filled with water. 2. If bowls having narrow bases are used for storing food, they may tip if they are placed on the shelf of a refrigerator. This trouble can be prevented by setting the bowls on tin-can covers or beverage-glass coasters laid on the shelf grating

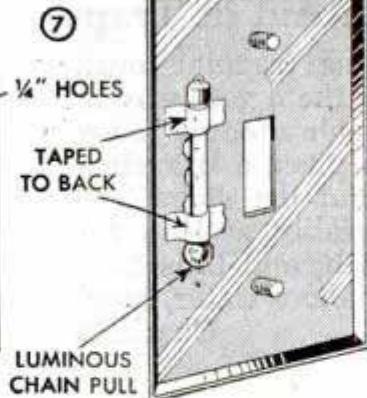
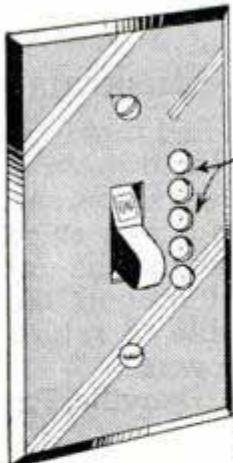


3. To eliminate cooking odors, sprinkle ground cinnamon or nutmeg on an electric iron that is set bottom up in a bowl, then plug in the iron for heating. 4. Rubbing shirt or blouse buttons with an ink eraser is a good way of removing discolorations sometimes left on them by laundering



5. By cementing pieces of linoleum to the sides and bottom of a cutlery drawer, you can keep the drawer clean more easily, especially if the linoleum is waxed so that it may be wiped with a damp cloth. 6. A spool of thread will not roll far when it accidentally is dropped to the floor if you take the precaution of pressing a round-head upholsterer's tack or a thumbtack into one edge

PROBLEMS



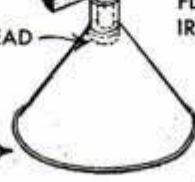
⑦
1/4" HOLES
TAPED TO BACK

LUMINOUS
CHAIN PULL

BICYCLE
HANDLEBAR
GRIP ↴

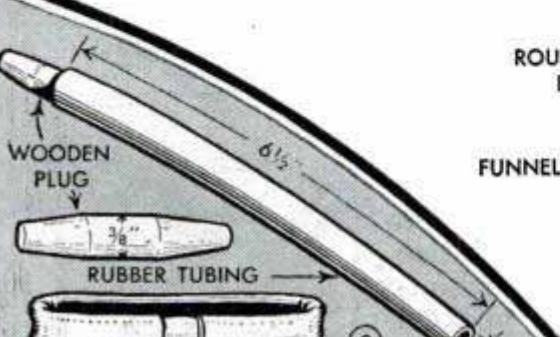
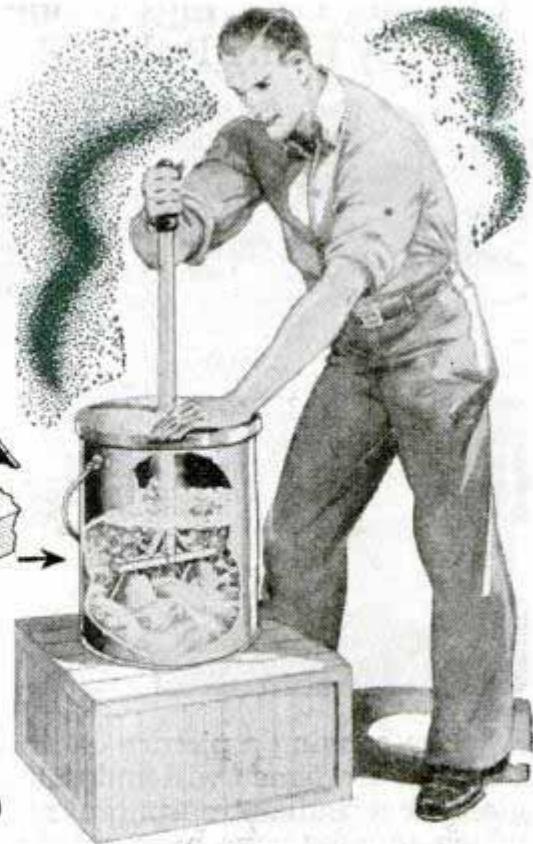
1" X 1"
HARDWOOD

FLAT
IRON



ROUNDHEAD
BOLT
FUNNEL →

⑧



WOODEN
PLUG

6 1/2"

RUBBER TUBING

3/8" ↴
1/2" ↵

⑨

ELECTRIC
BELL

LEATHER BALL

SPIRAL CHIME

⑩

9. Hair curlers that can be worn without discomfort when you sleep are made from lengths of rubber tubing and wooden plugs. The hair is wound tightly on the tubing, the ends of which are bent inward and held by being slipped over the plug. 10. By removing the gong from a doorbell and substituting a spiral chime taken from an old mantel clock you will have a soft-toned door signal instead of a harsh bell.

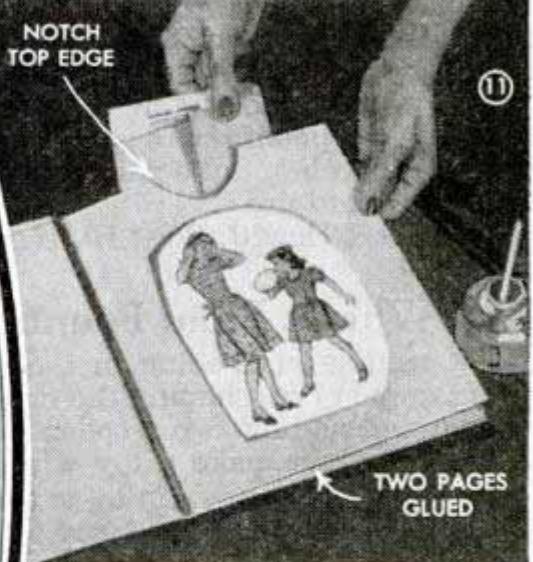
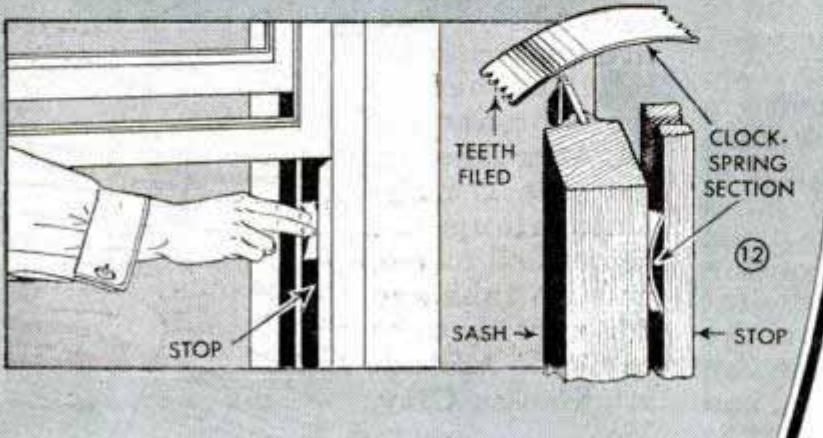
TEETH
FILED

SASH →

CLOCK-
SPRING
SECTION

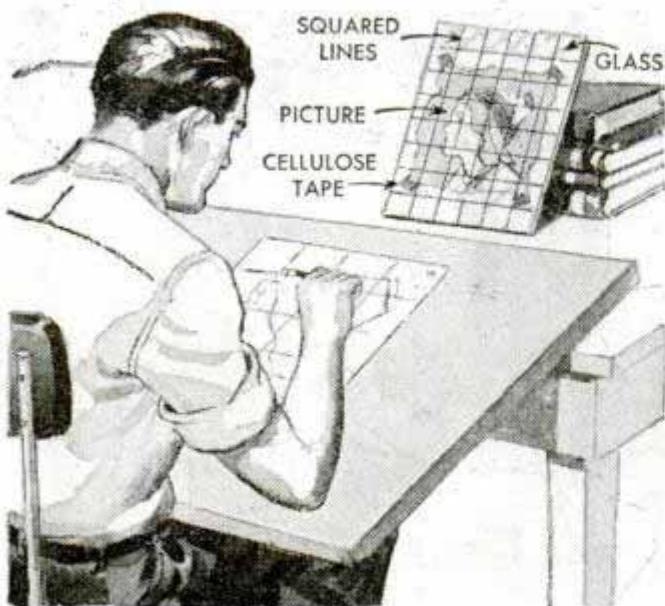
⑫

STOP



11. Scrapbook pages glued in pairs form pockets to hold sewing patterns. A picture on the pocket identifies the pattern. 12. Sections of clock spring between sash and stop prevent rattling of windows

Copying Drawings Is Simplified By Using Ruled Glass



When copying a picture or drawing, artists and draftsmen will find that a sheet of glass, or a similar transparent material, on which squares have been ruled will make their work more accurate. The lines are drawn on the glass with waterproof ink. To use the guide, fasten the work to the underside of the glass with cellulose tape. The squares will locate the various parts of the drawing so it can be copied on paper ruled with similar squares.

Michael Ligocki, Gary, Ind.

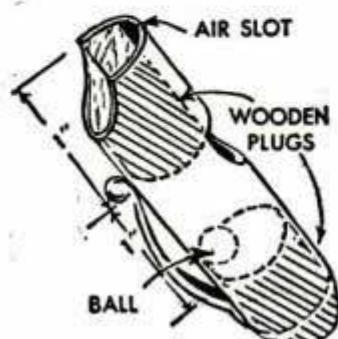
Water Soluble Paints Restored With Baking Soda

Some water soluble paints, if exposed to air and later stored, will become rancid in time. If this happens, the paint can be restored by straining it through a clean piece of cheesecloth and adding a small amount (about a teaspoonful to a gallon) of baking soda. Stir well and the paint will be ready for immediate use.

Robert Hewitt, West Hartford, Conn.

Toy Whistle From Fountain Pen

By cutting an opening in the side of a fountain pen cap, shaping the open end as shown and adding two wooden plugs and a ball, you can make a toy whistle. One plug is rounded to fit snugly within the closed end of the cap and pressed into place. Then a wooden ball somewhat larger than the cutout in the cap is dropped in, and the other plug is



added. This has a flat cut on one side for an air slot. The clip on the cap is used to hold the whistle in a pocket or on a trouser belt.—Albert E. Fenn, Chicago.

An Aid in Trapping Muskrats

When trapping muskrats I find that fewer of them get away if I set the trap stake in water a foot or more from the shore, and then place a branch or limb a foot or so beyond the stake. When caught the rat invariably swims out and around the branch, and thus being unable to return to shallow water, quickly drowns.

Charles Swope, Danville, Pa.

Bowler's Crayon in Lipstick Case Does Not Soil Pockets

Bowlers who like to keep a piece of crayon in their pockets for marking scores can prevent the crayon from soiling their pockets by enclosing it in a lipstick case. The crayon can be pushed out for use and retracted into the case as required.

William Swallow, Brooklyn, N. Y.



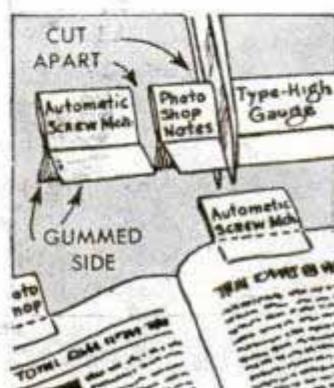
Primer for Sheet-Metal Painting

When painting sheet iron with plastic-base paints, whitewash or other cold-water finishes, the paint is less apt to run and will be more permanent if the surface to be painted is rubbed with vinegar and allowed to dry completely before the paint is applied. The vinegar corrodes the sheet iron just enough to provide a rough surface to which the paint will adhere readily.

E. P. Barnhart, Whittier, Calif.

Tape Index Tabs for Magazines

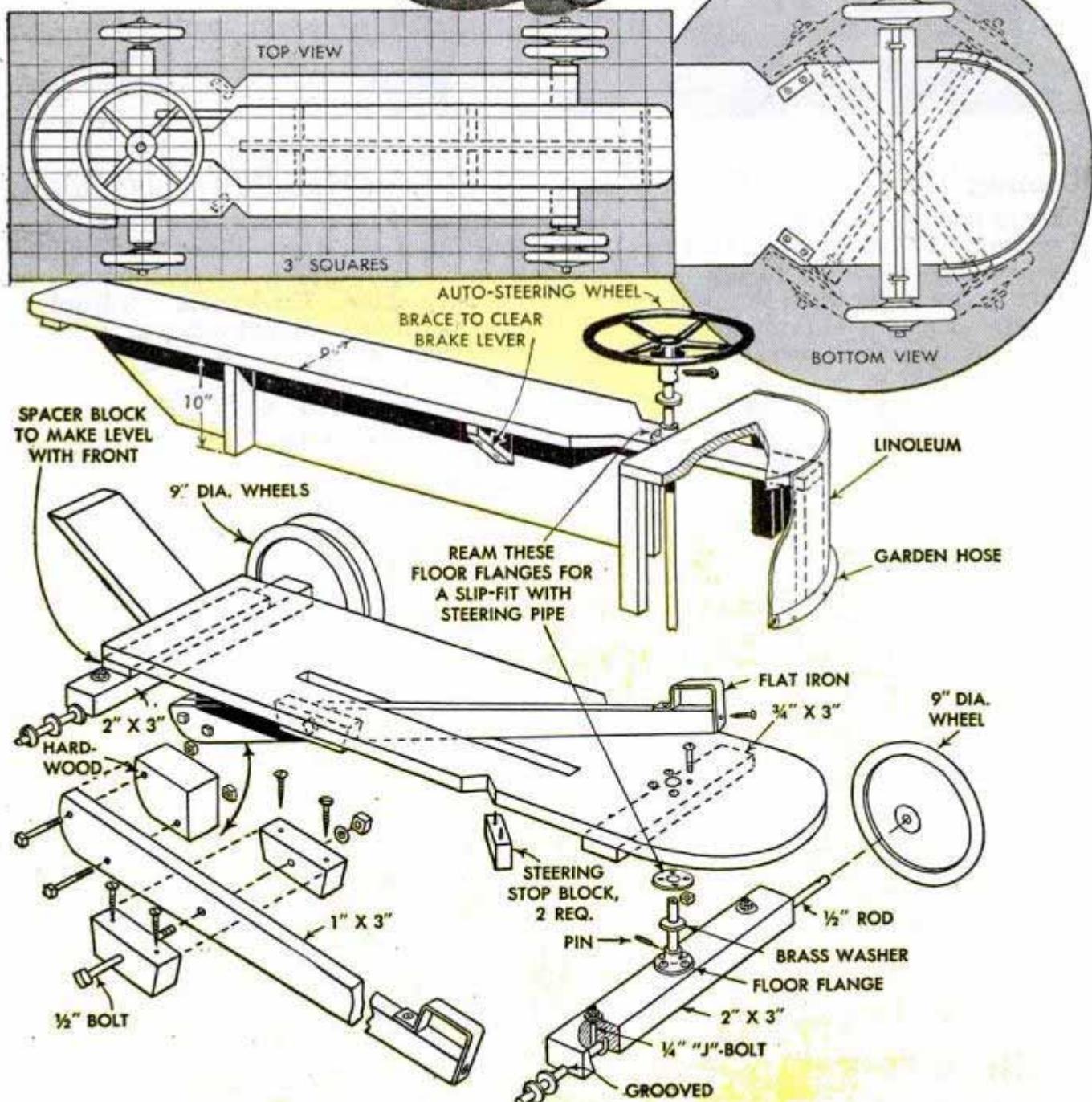
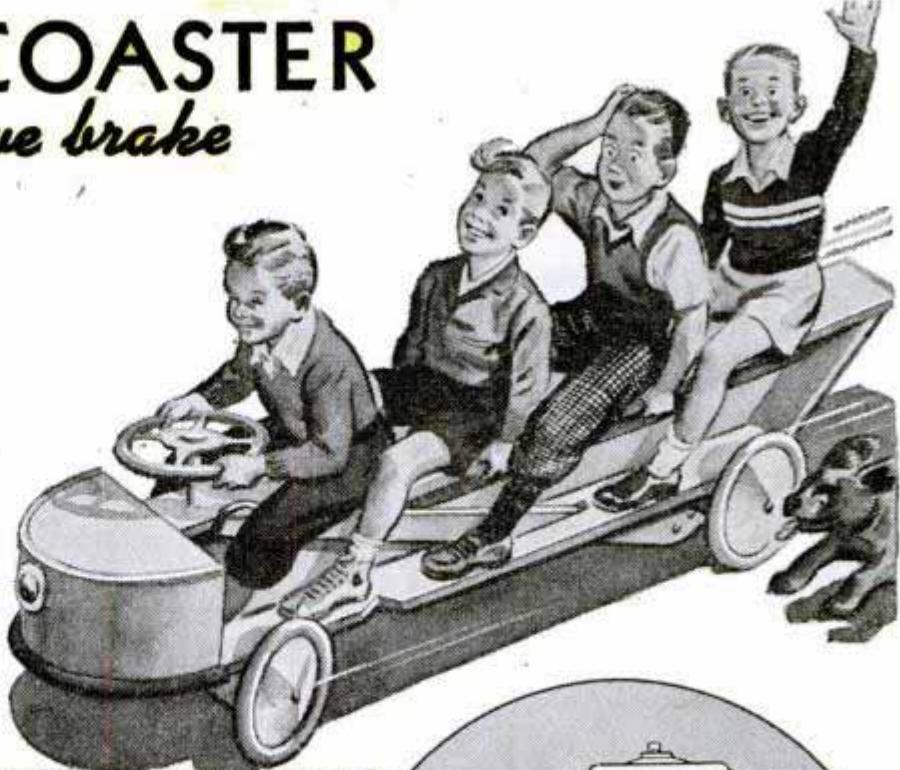
Index tabs cut from a strip of gummed-paper tape for use as markers on pages of a magazine are in some cases preferable to cloth tabs because the strip can be inserted in a typewriter for labeling before the tabs are cut off. After labeling, the strip is moistened along the center and folded, and the tabs are cut off ready to be applied.—A. Stewart, Kansas City, Mo.

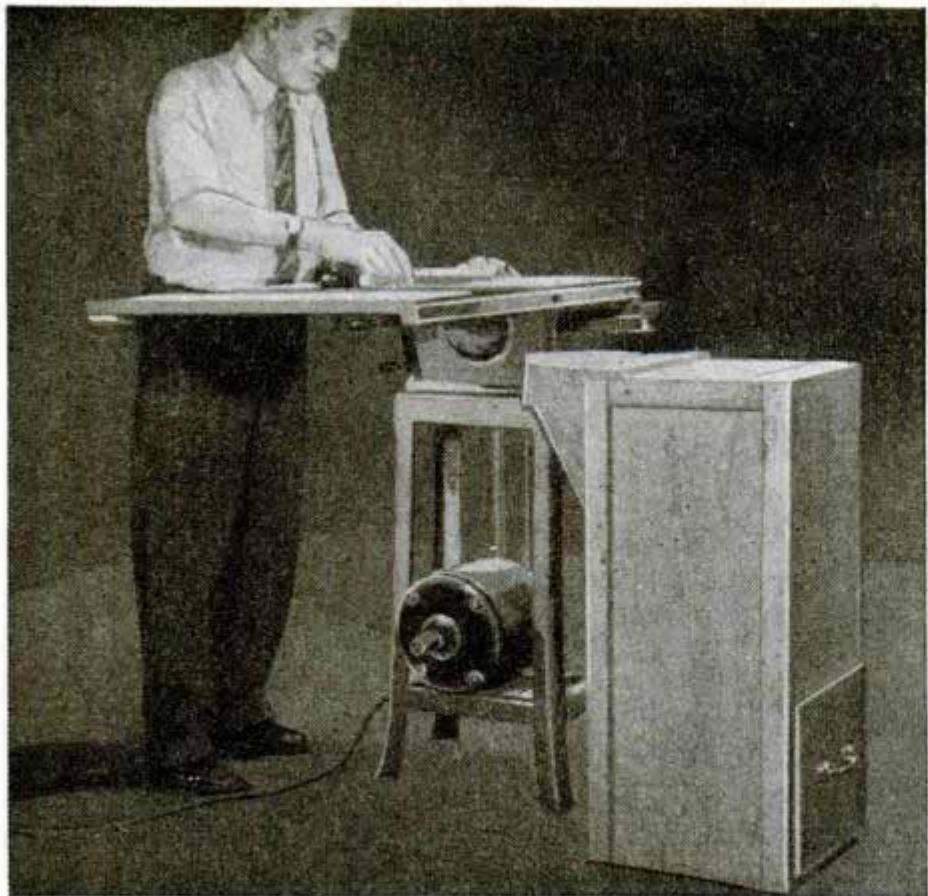


4-PLACE COASTER

has positive brake

Equipped with a direct-action brake, this coaster is sturdy enough to carry four passengers who straddle a long seat bicycle fashion. The chassis is rounded in front and covered with linoleum to simulate an auto grille, and is notched at the sides to shorten the turning radius. The wheels are kept from rubbing against the chassis by stop blocks. A brake lever pivoted to the chassis has a handle for ease in raising it. This forces the wooden "brake shoe" against the pavement to stop the coaster.



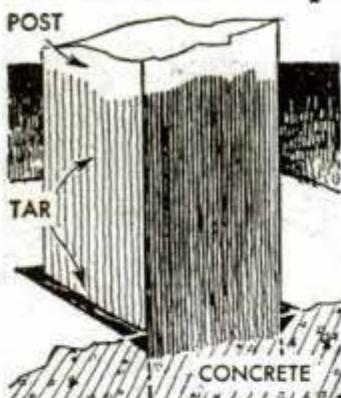


Drawer in Cabinet Collects Sawdust

Instead of tying a burlap sack over the spout of a circular saw to collect sawdust, or allowing it to spill onto the floor, one craftsman fitted his saw with a cabinet containing a drawer from which the sawdust could be removed. Use of the cabinet thus saves the work of retying a sack after emptying it and helps keep the room clean. The cabinet is built of plywood nailed to a light frame, or a wooden packing case can be used. A chute attached over an opening cut in the cabinet fits on the saw spout to direct sawdust into the cabinet.—W. F. Messenger, Ballston Spa, N. Y.

Roofing Tar Protects Fence Posts

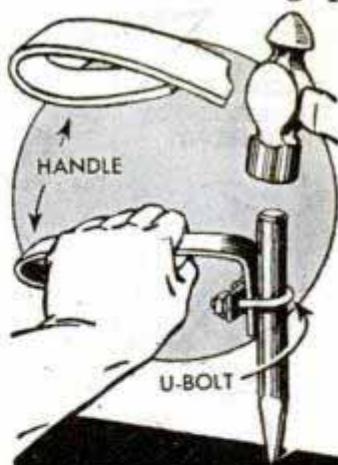
Fence posts that are set in concrete are likely to decay rapidly at ground level unless a seal is provided to prevent water from seeping in between the post and the concrete. A good seal is made by applying roofing tar at the juncture of post and base. The tar should be poured into a beveled recess at the edge of the concrete around the post as indicated.



The recess can be made easily after newly poured concrete has been allowed to set for about 20 min.—Mrs. T. F. Watts, Charlotte, N. C.

Flat-Iron Handle Holds Chisel

Attached by a U-bolt, this handle for a cold chisel will prevent a worker's fingers from being injured if the hammer glances from the chisel. The handle is a length of light flat iron looped at one end for a grip and bent to a right angle at the other. This is slipped into the U-bolt and held by a cross-piece that is tightened against it by nuts. By loosening these, the bolt may be adjusted to hold the handle at any position.—J. Burton, Pattonsburg, Mo.



Cards to Be Sprayed Are Held By Masking Tape

Small cards can be held for all-over spraying by using masking tape. A length of the tape is tacked to a board with the gummed side facing out. Then the cards are stuck to the tape as shown. The setup can be used repeatedly.

When streets and sidewalks are icy, stick a strip of adhesive tape crosswise on the sole of each shoe to keep from slipping.





CACTI

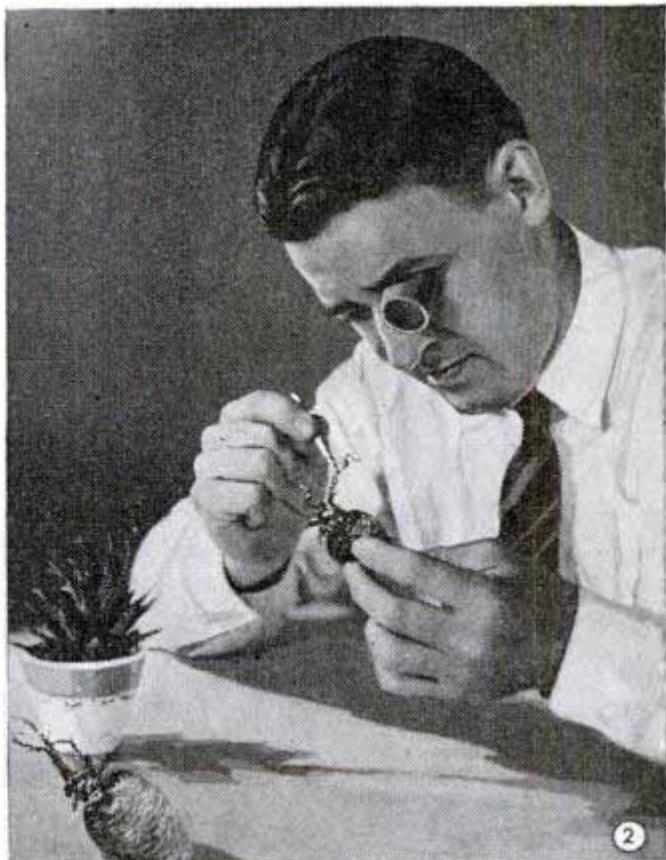
All-season house plants

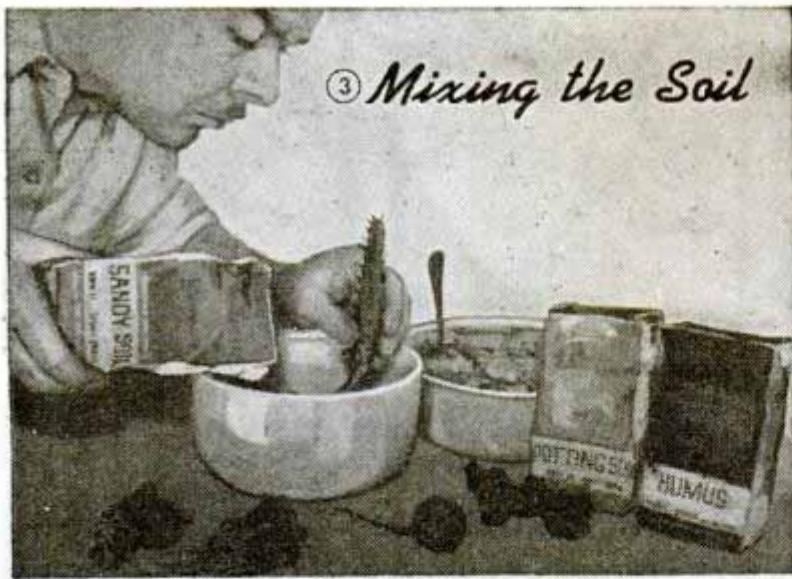
By Alexander Maxwell

BECAUSE there are so many varieties and shapes, raising cactus is a kind of indoor gardening that will not easily become monotonous. In shape, some plants are globular, some cylindrical and some columnar, while others are flattened, or ribbed like a cantaloupe. Several species, including the prickly pear, are edible, and others serve as forage for cattle, while still others are cultivated solely for their showy, delicately colored flowers.

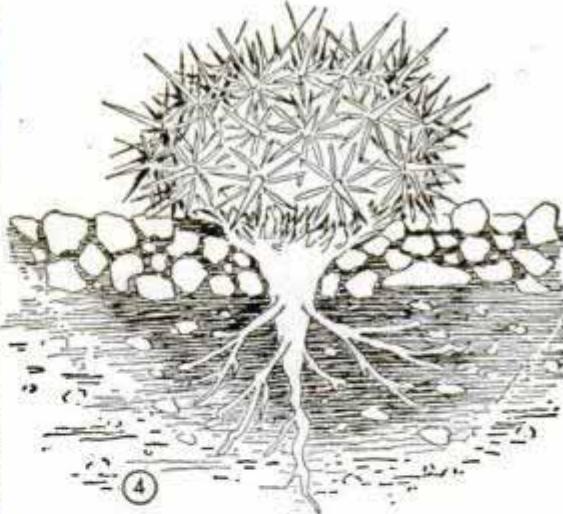
Possessed with a camel-like ability to store water in their fleshy protuberances, cacti are plants that not only survive in the desert but in some instances attain unusual size. The giant cactus of Arizona and other southwestern states, for example, attains a height of 40 to 70 ft. with a diameter of about 2 ft. However, there are many smaller varieties that are suitable for cultivation in the home conservatory. Some of these are shown in Figs. 5 to 10, and 12 to 15.

Such plants usually can be purchased from nurseries and florists. Wild cacti sel-





③ Mixing the Soil

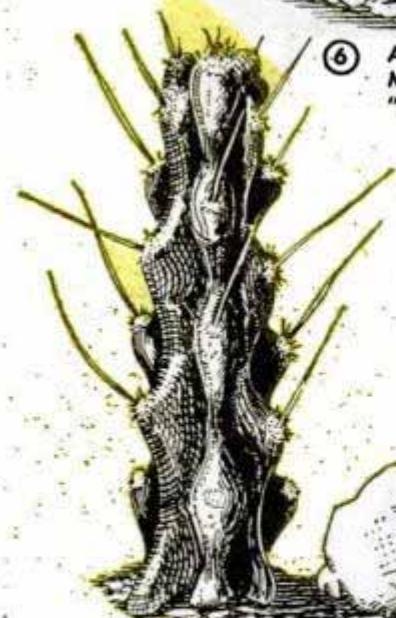


Types of Cacti

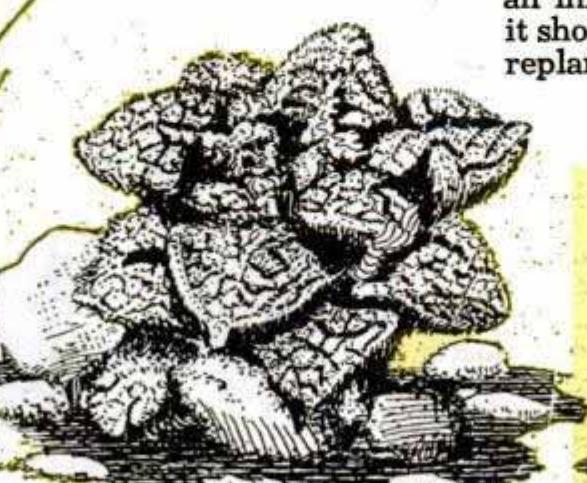
⑤ CORYPHANTHA PALMERI
Sharp, curved thorns like cat claws



⑥ ASTROPHYTUM
MYRIOSTIGMA POTOSINA
"The Bishop's cap"



⑦ ERIOCEREUS
MARTINII
Green, purple
and lumpy



⑧ ARIOCARPUS FISSURATUS
"The living rock"

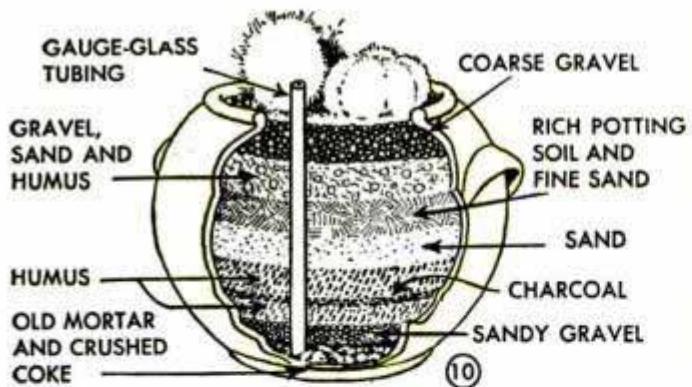


⑨ EPITHELANTHA MICROMERIS
Looks like a lost button

dom survive the artificial atmosphere of a house and generally are infested with insect pests. The best plants for home culture, therefore, are those grown for this purpose from selected seeds nurtured under ideal conditions. These usually are well formed, healthy and free from pests.

When the plants arrive, unpack them carefully. If they are shipped in pots, wash away the soil using a hose connected to a faucet, Fig. 1, to avoid injuring the plants by pulling them up. Then snip off all roots that are dried or broken, and inspect the plants for pests such as spiders, scale and insect eggs. When looking for parasites, also note any bruises, Fig. 2, that may have been caused by rough handling. If the plants are in good condition, roll the roots in clean sand and repot as soon as they are dry.

Cacti are delicate, in spite of their bristly appearance, and are easily bruised. When this happens, decomposition sets in and the plant will die if not treated. If there are signs of damage, the injured tissue must be cut away carefully with a sharp knife, Fig. 19, and the plant laid with the cut portion uppermost until a scab forms. Then it can be planted temporarily in pure sand and heated frequently with an infrared lamp. While healing, it should be watered often and not replanted until it shows definite

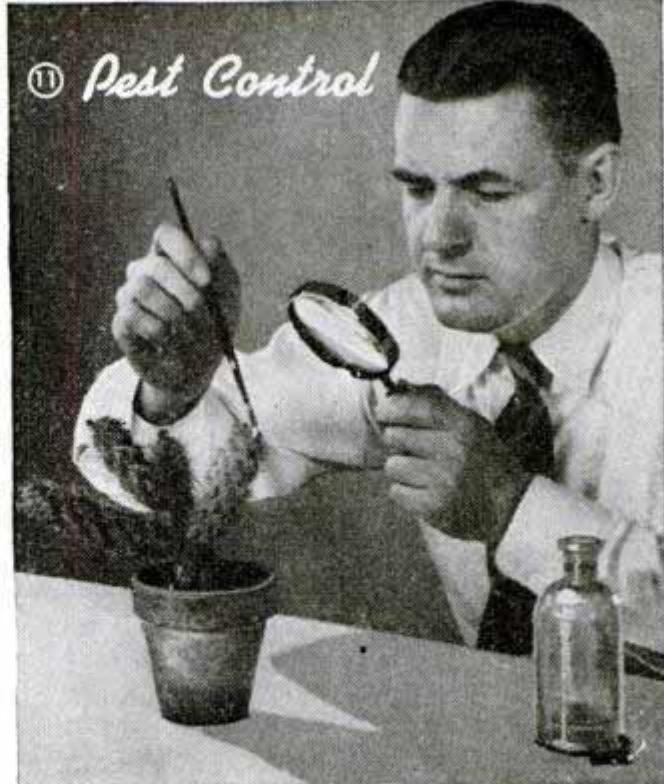


signs of recovery. The period of convalescence may be two or three months.

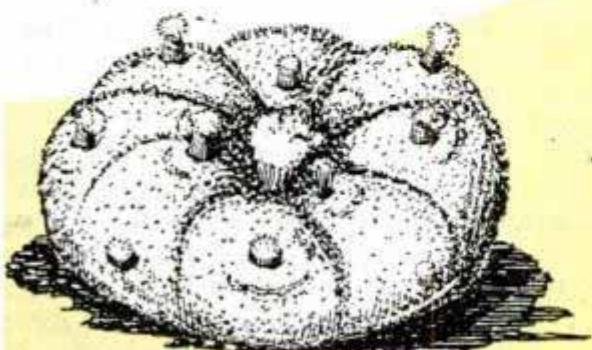
Growing cacti in the house is not a very difficult job; however, the right kind of container is important. Terra cotta flowerpots are not desirable because they absorb too much water, causing the soil to pack. This in turn will cause the roots to dry out and die. Also, as water evaporates from the outside of the pot, a cooling effect is obtained which may chill the roots. Wooden tubs are the best containers, but glazed pottery or porcelain will be most ornamental. Bean pots, mixing bowls and Mexican cooking ware add a touch of color to a living room and are entirely suitable to the needs of cacti.

Soil, too, is important. No cactus will thrive in sand alone, even though many species grow in the desert. Desert soil is light and fluffy, rich with wind-blown leaf dust and other nutrient elements, and there is enough moisture—enough for the cactus. Therefore, when growing cacti at home, these conditions must be duplicated as closely as possible. The soil can be made to order by mixing easily obtained ingredients: humus (decomposed leaves and other vegetation), potting soil (a composite of black, sandy loam and humus), gravel, old plaster, charcoal and crushed coke. These are placed in layers in the pot, Fig. 10, so the soil will be loose and porous as it is in the desert. The roots of cacti must have air.

Under no conditions must the soil be more than slightly damp. To determine the moisture content, press a length of glass tub-



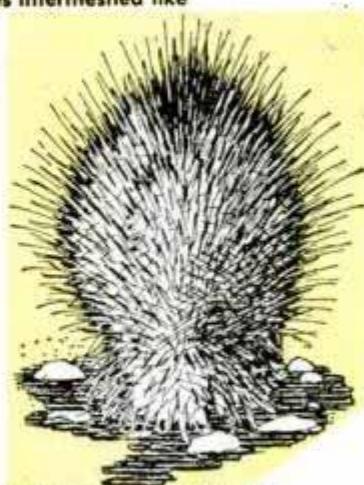
⑫ ECHINOCEREUS REICHENBACHI
Delicate white spines intermeshed like dainty lace



⑬ LOPHOPHORA WILLIAMSII
Mescal, or dumpling cactus



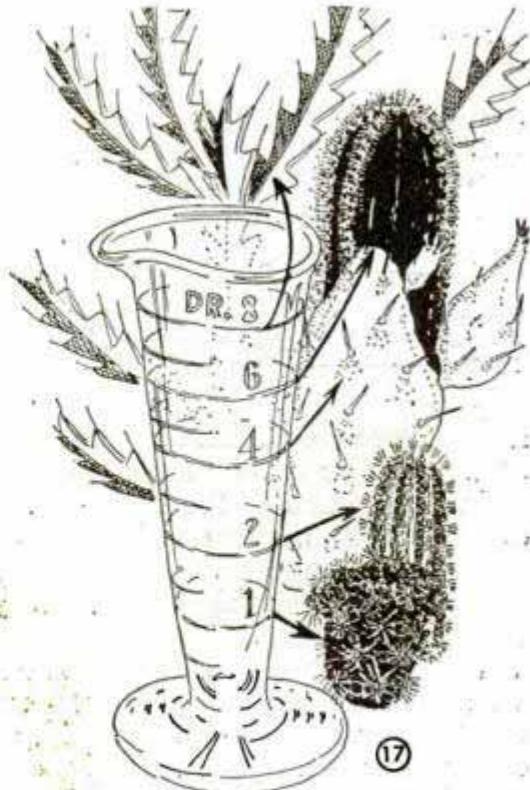
⑭ CEPHALOCEREUS SENILIS
The "Old Man" Cactus



⑮ NOTOCACTUS SCOPA
A living red-and-silver Christmas-tree ornament



16



17

ing down through the soil, Fig. 10, and insert a water-color brush in the tube. If the brush is damp when withdrawn, the soil is too wet. Another function of the tube is to act as a vent or breather tube for the roots.

To set plants in filled-pots, scoop out a depression for the root and, holding the plant erect, pack a cushion of gravel under it as in Fig. 4. The gravel will keep the plant dry and free from mildew. Usually four or five plants can be set together in one pot at the beginning, but, as they grow, some may have to be transplanted to avoid crowding. Since some species grow quite large while others mature and die when they reach the size of a man's thumb, it is best before planting to determine which types to group. The table under Fig. 17 will guide you.

The growth pattern for the different species varies widely. For example, the *Astrophytum* shown in Fig. 6 develops very slowly; a spine will start in the center of first one, then another, of the five lobes and gradually advance toward the edge, but there is little evidence of growth from month to month. Growth of *Echinocereus*, Fig. 12, starts as a tuft of soft down and slowly develops into a crown. In selecting types of cacti, it is best not to mix jungle varieties with the desert types such as the large growing species shown in the table. As a general rule, jungle cacti bloom quite frequently, but so-called fancy types rarely do, except when growing in their natural state.

From time to time the plants should be inspected under a magnifying glass. Soot and dust collect in the deep creases and under the spines to hide the sleek shine of a healthy plant. The best means of removing this accumulation is a long-haired showcard brush, Fig. 11. This is also an effective tool for exterminating insect pests which, if allowed to feed and multi-

General classification of Cacti which may be grown in the home			
Large Growing	Jungle	Tiny Plants	Fancy Cacti
<i>Echinocactus</i>	<i>Echinopsis</i>	<i>Astrophytum</i>	<i>Cephalocereus</i>
<i>Carnegiea</i>	<i>Epiphyllum</i>	<i>Echinocereus</i>	<i>Coryphantha</i>
<i>Cleistocactus</i>	<i>Eriocereus</i>	<i>Epithelantha</i>	<i>Espostoa</i>
<i>Ferocactus</i>	<i>Heliocereus</i>	<i>Frailea</i>	<i>Hamatocactus</i>
<i>Gymnocalycium</i>	<i>Hylocereus</i>	<i>Lobivia</i>	<i>Leuchtenbergia</i>
<i>Lemaireocereus</i>	<i>Monvillea</i>	<i>Mamillaria</i>	<i>Notocactus</i>
<i>Melocactus</i>	<i>Nyctocereus</i>	<i>Rebutia</i>	<i>Pereskia</i>
<i>Opuntia</i>	<i>Peniocereus</i>		<i>Stenocactus</i>
<i>Oreocereus</i>	<i>Rhipsalis</i>		
<i>Rothbunia</i>	<i>Selenicereus</i>		
<i>Trichocereus</i>	<i>Zygocactus</i>		

ply, will in time devour an entire plant. To kill such pests, dip the brush in alcohol and apply it under the spines and along the crevices that show signs of parasitic destruction.

In watering plants, the schematic guide shown in Fig. 17 indicates their widely varying needs. For small plants, one dram usually will be sufficient, while larger ones will need 8 drams, or one-half oz. The water is poured gently along the edge of the pot, Fig. 16, and allowed to soak into the soil. Water should never be poured directly on the cactus because a wet, soggy plant molds rapidly. For this reason, too little water is preferable to too much. Cactus will store up a year's supply of moisture and water should be added only to replace that consumed.

Strong light can be harmful; contrary to popular belief, cacti do not thrive in hot sunlight but prefer shady areas or locations where the sun will strike them only for part of the day. Jungle cacti, as the name implies, grow almost entirely in deep shade. Too much light, like too much water, destroys the color and leaves a bleached, drab-looking plant. However, in the house, a northern exposure is not likely

WET

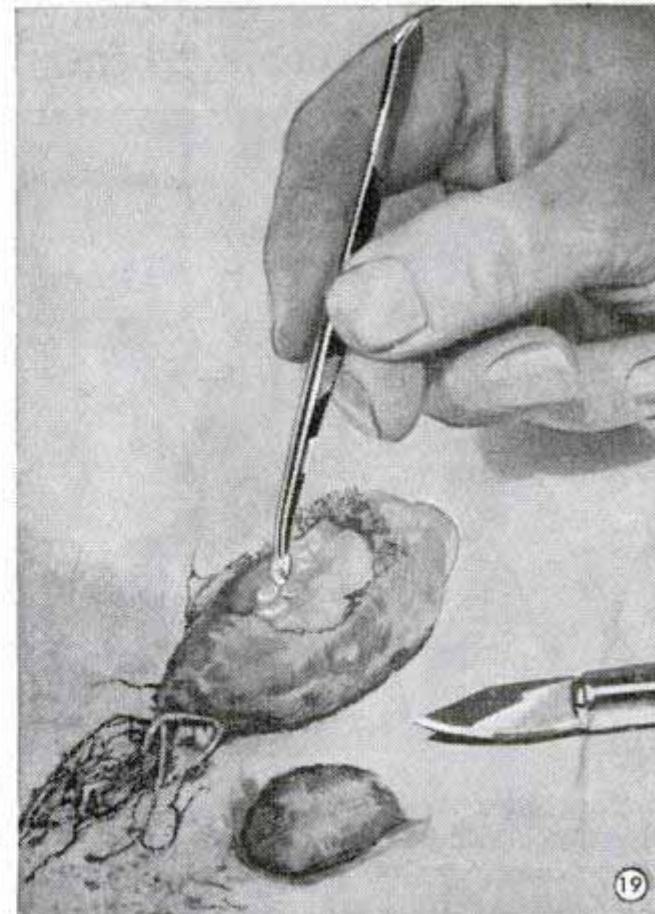
DRY

Soggy plants mold rapidly	Protect green cacti from sun
Do not water	Water daily
Indoor Weather	
Moist air	Steam heat
Keep plants in sunny window	
Water twice weekly	Water every other day
Use artificial heat on growing plants	Get all sunshine possible
Water every four days	Water twice weekly
Do not water. Put plants in warm, dry spot	
Winter Care	
Remove plants from window at sundown. Put on high shelf in heated room free from drafts	
(18)	

110
100
90
80
70
60
50
40
30
20
10
0
10
20

to harm cacti, even in summer.

In regard to growing temperatures, heat is preferable to cold. If chilled, the plant will stop growing and the buds will wither. A temperature of 100 deg. for an hour or two a day will speed the growing process. High humidity is dangerous because it promotes the development of



fungi. When the weather is damp or chilly, an infrared heat lamp can be directed at the plants, or they can be placed on a shelf near a hot-water tank or boiler. The chart, Fig. 18, will serve as a guide for wet and dry weather at various temperatures.

Gate Is Held by Latches That Have No Moving Parts

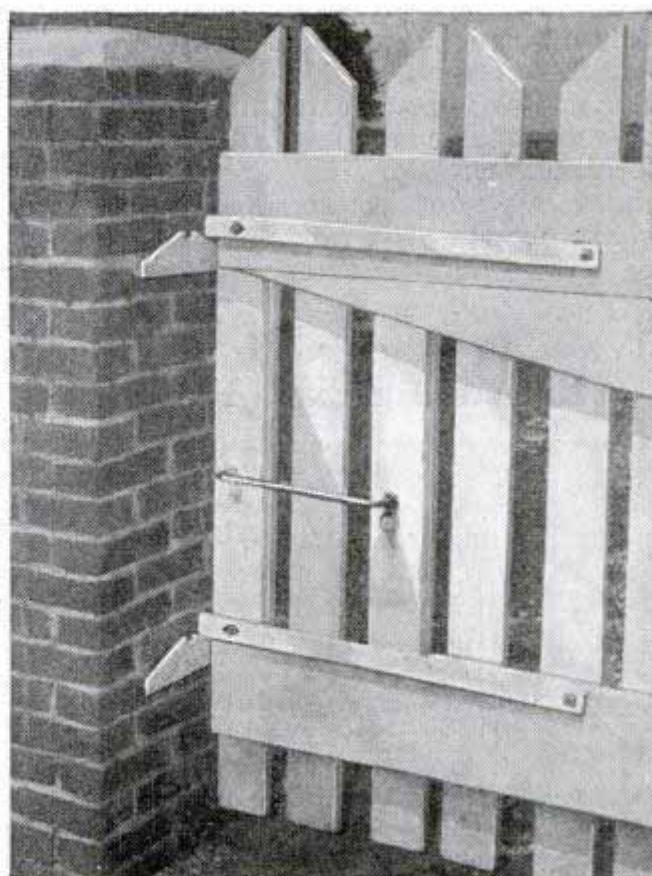
No springs or levers are needed on this gate as it has two latches that serve not only to keep it closed but also to help support its weight. The latches are made by bolting two strips of flat iron to the gate so as to project slightly. The ends of the strips are held in notched fittings attached to the gate post. Sides of the fittings are sloped upward toward the center as shown to guide the strips into the notches. The gate is lifted slightly to open or close it, a handle being screwed to the gate pickets for this purpose.

A. M. Wettach, Mt. Pleasant, Iowa.

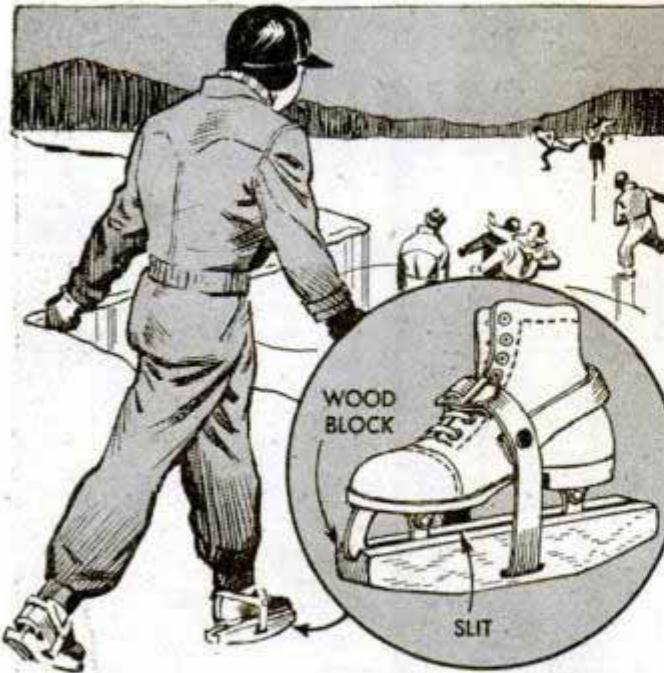
Corks Are Used for Cleaning Jobs

Rather than throw away old corks, save them for cleaning purposes. For example, a cork dipped in kerosene or gasoline will take spots off linoleum or windows when other methods may fail. And a cork rubbed in soap or dipped in cleansing powder will do a good job of cleaning kitchen knives. You also can dip a cork in paraffin and use it to clean the tiles of a fireplace hearth.

Frank G. Harris, Flint, Mich.



Blocks Strapped to Skate Runners Permit Walking on Them



There's no need to wait until you reach the ice pond before you put on your skates if you have a set of wooden blocks like the ones shown for protecting the runners. The blocks are beveled at both ends to make walking easy. They are grooved for the runners and slotted for 1-in. webbing. This has a buckle at one end and a strap riveted to fit over the shoe.

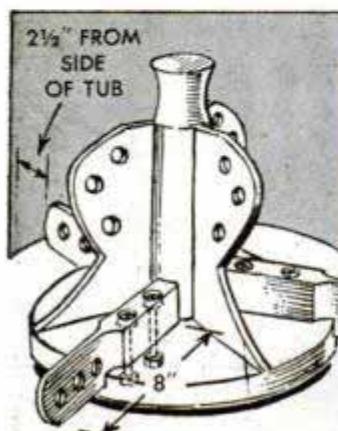
C. H. Brown, Bel Air, Md.

Concealing Duplicate Auto Keys

To make sure that a set of duplicate keys is available if you lock one set in a car, it should be wrapped in a container and concealed on the outside of the car. Cellulose makes a good container to keep the keys clean, or a small metal tube corked at both ends will do. The container is taped under a fender or in some other place where prowlers are not likely to search.

Dorothy Norris, Geneva, N. Y.

Washing Machine Is Improved By Adding Extra Paddles



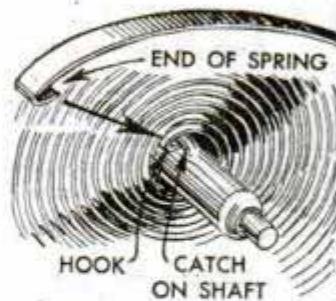
Three pieces of hardwood bolted to the gyrator of a washing machine to serve as auxiliary paddles not only will agitate the laundry more thoroughly when the tub is full, but will make it possible to wash just a few garments when the tub is

only partially filled with water. The paddles should be shellacked and varnished, and when attached to the gyrator they should extend to within $2\frac{1}{2}$ in. of the sides of the tub.—Robert F. Fry, Flora, Ill.

Repairing a Broken Clock Spring

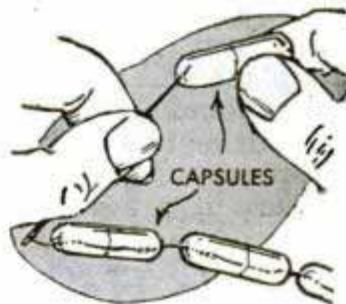
Alarm clocks that are sometimes thrown away because of a broken mainspring can be repaired easily if the break has occurred fairly close to the shaft end of the spring. Anneal the spring at the broken end and form a hook on it to slip over the catch on the shaft. After reinstalling the spring, wind it slowly so that it will take its shape properly. The clock should now operate in a normal manner.

Wayne Sheppelman, West LaFayette, Ind.



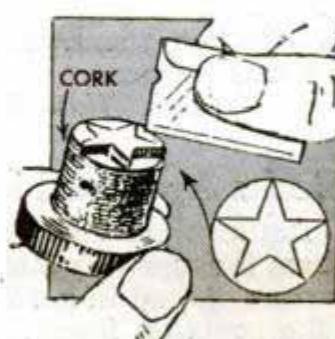
Capsules Make Colorful Beads

Empty medicine capsules, obtainable at your local drugstore, can be lacquered with nail polish to make a novel string of beads. First puncture the ends of the capsules with a large sewing needle and then string them on a strong thread. Apply an even coat of polish to the capsules and allow them to dry. If desired, alternate capsules may be lacquered with contrasting shades. Also, large and small capsules may be strung alternately.—Frank Shore, New York.



Star Stamp Cut From Bottle Cork

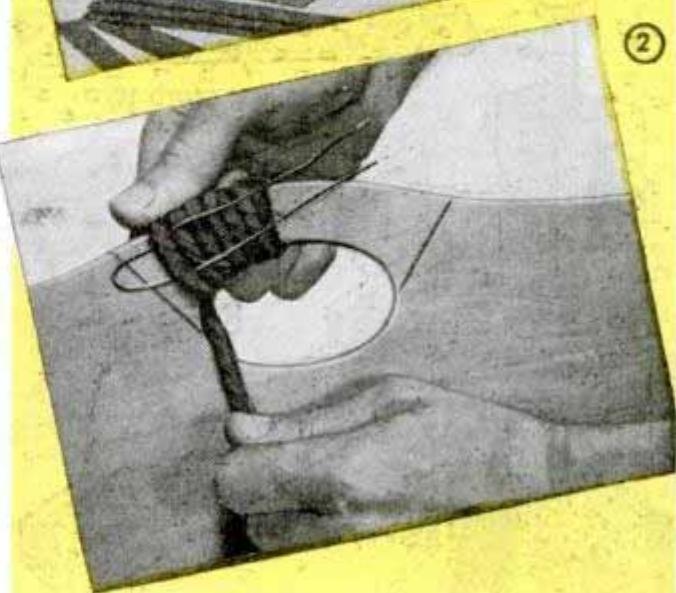
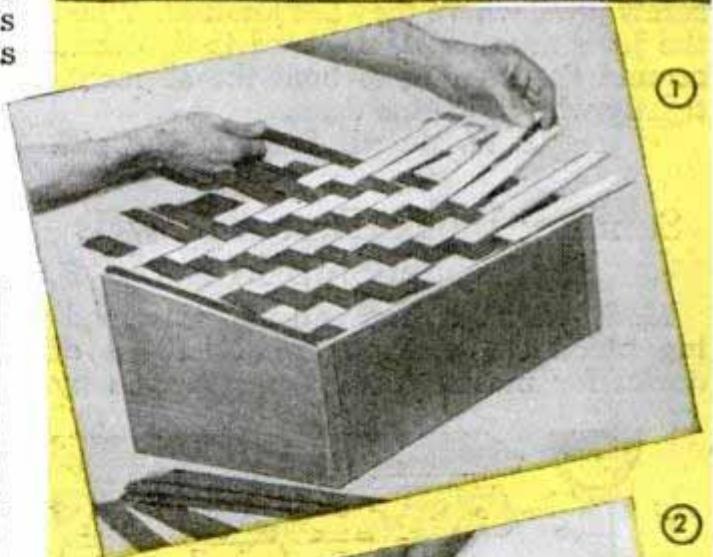
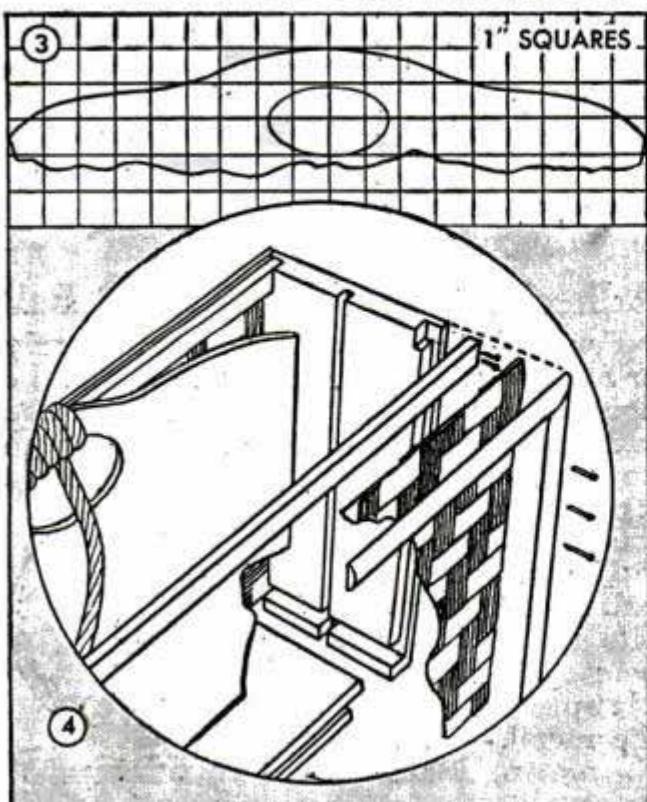
Children will enjoy this star stamp which can be made from an ink-bottle cork. The design is cut by first pasting a piece of paper on the end of the cork, then drawing the star on the paper and cutting around the outline with a razor blade. If the paper will not come off without pulling out pieces of cork, soak it in hot water. Designs other than the one shown can be made to build up a set of stamps.—J. J. Gold, Brooklyn, N. Y.



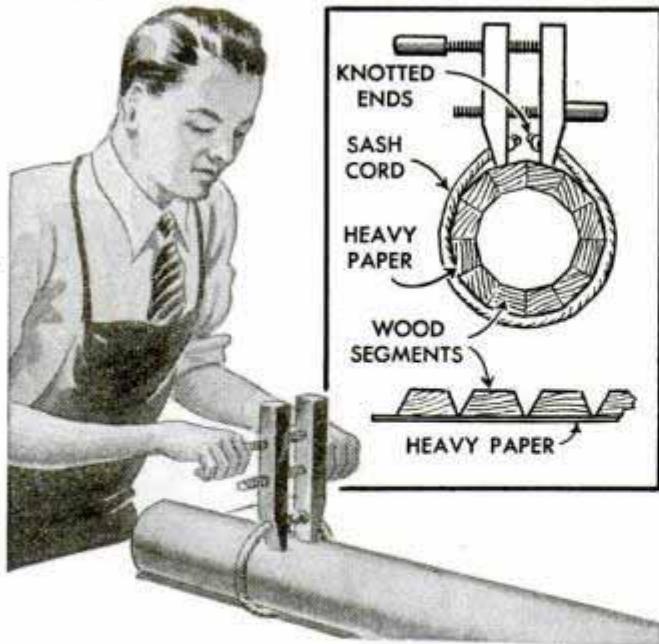
MAGAZINE RACK Has Splint Sides

WITH a rope-wound handgrip and sides formed of splints, this rack for magazines is exceptionally pleasing in appearance, yet easy to make. It can be any size, with ends and bottom of $\frac{3}{4}$ -in. stock and a partition of $\frac{1}{4}$ -in. material. The partition is glued into grooves cut in the ends, which are dadoed to fit over the bottom where they are glued. Two strips of wood are set into rabbets at the upper corners of the ends and bradded in place to support the splints. The inner edges of the end pieces also are rabbeted to take the sides, as indicated in Fig. 4. The sides are made by attaching splints horizontally with lengths of molding to the edge of one of the end pieces, then weaving other splints across and through them as in Fig. 1. If desired, some of the splints may be stained and interwoven with others that are not stained, as shown in the illustration. When the splints have been woven, they are trimmed to fit and molding is applied over them along the other end of the rack and across the top and bottom edges. The handgrip is shaped as in Fig. 3 and wound with rope as in Fig. 2. The rope should be wound from the center toward the ends to prevent loosening, and the ends of the rope are hidden by being pulled through the coils with a bent wire.

Charles and Bertram Brownold.



Glued Column Work Is Clamped By Cord in Hand-Screw Jaws

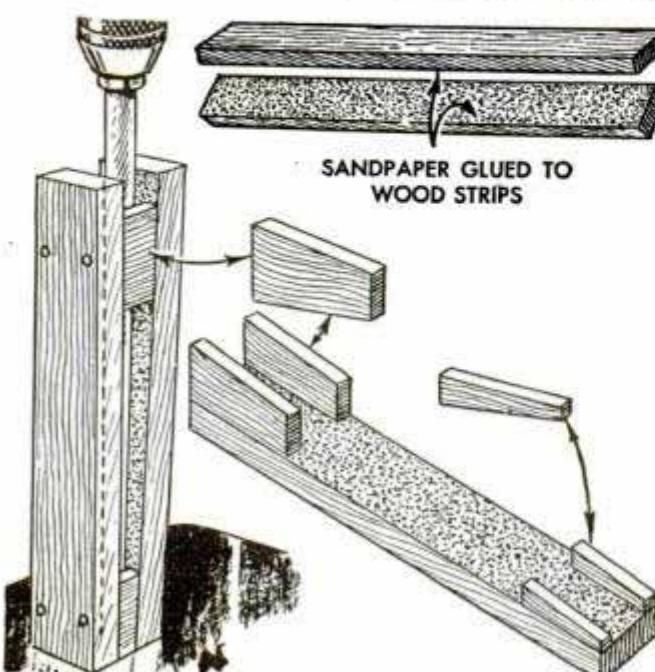


Columns composed of wood segments may be clamped for gluing by using an ordinary hand screw and a length of sash cord. Glue is applied to the sides of the segments, which then are aligned carefully on a strip of heavy paper and assembled into a column. The sash cord is looped over the column and the ends of the cord are inserted through holes drilled in the hand-screw jaws, where they are knotted. When the jaws are closed, the cord is tightened around the column to hold the segments tightly while the glue dries.

E. H. Merrill, San Rafael, Calif.

Sanding Block Tapers Dowels For Model-Ship Masts

Model-ship builders will find this sanding block useful in tapering lengths of dowel for masts. The block is made by



gluing sandpaper to two wooden strips, which then are nailed to four tapered spacing blocks. These are shaped to produce the desired taper on the masts. In operation, a dowel is chucked in a drill press and lowered into the guide gradually while being rotated. If no drill press is available, the work may be rotated in a hand drill, or by twirling it between the palms of the hands.—A. H. Waychoff, Phoenix, Ariz.

Refilling Small Spouted Cans From Glass Containers

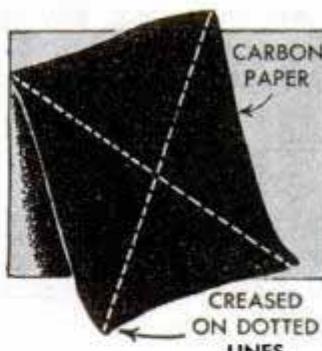
Small containers that have spouts, such as those used for lighter fluid, can be refilled from bottles by using a cork that has been bored for the spout. The latter is pressed tightly into the cork, after which bottle and container are inverted. By pressing on the sides of the container, air will be forced out and fluid will be drawn in.

James F. Curtis, Aberdeen, Md.



Carbon Paper Creased Diagonally To Prevent Curling

Carbon paper will not curl when used in a typewriter if it first is creased from opposite corners as shown. The creases will not appear on the copies. — Tom McKitch, Vancouver, B. C.

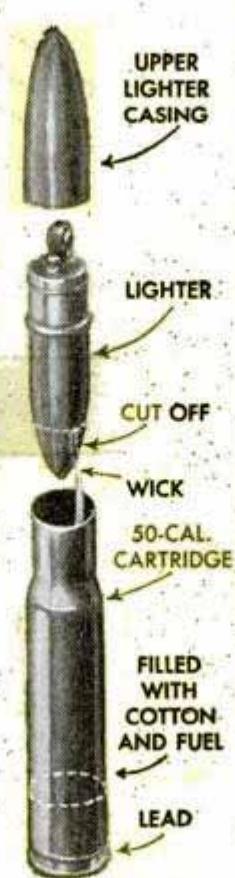
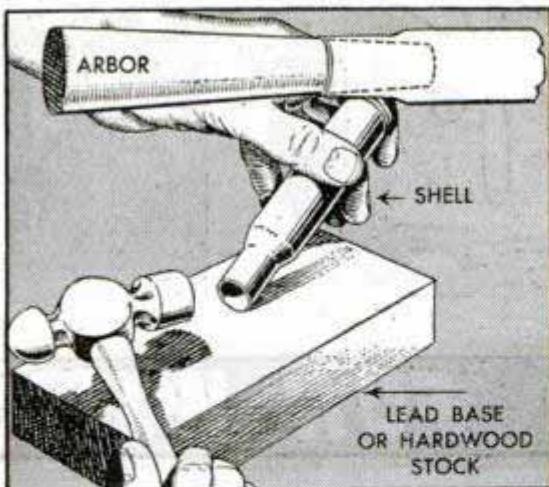


Adhesive Tape Will Muffle Bell

For the benefit of those who retire early or for any other reason wish to muffle the noise of a doorbell, this solution should be satisfactory. Paste a piece of adhesive tape on the gong so the clapper will strike the tape and not the metal. When the full tone of the bell is desired, rotate the bell to a point where the clapper will hit the metal. —J. F. Faimann, Baltimore, Md.



Cigarette Lighter Made From .50-Cal. Cartridge



Empty .50-cal. cartridge cases—only those which have been fired—can be converted into attractive cigarette lighters. First, the empty case is annealed and an arbor, made by tapering a length of steel rod, is forced carefully into the neck of the case to expand it sufficiently to take a small lighter of the type having a bullet-shaped cap. After fitting the lighter, the case is held in the position indicated in the lower left-hand detail and the edges of the neck are tapped lightly with a hammer to turn them inward sufficiently to grip the lighter and hold it firmly in place. The case is weighted with lead as shown by dotted lines. To obtain a

brilliant finish the case is brightened with fine emery paper, rubbed with pumice or silver polish and coated with clear nail polish or lacquer. Where the assembled lighter is used only as a smoking-table accessory the lower tip of the lighter case is cut off and a longer wick is used in the cartridge case, which is filled with cotton saturated with lighter fluid as indicated in the center detail.

Movable Pointer on Board Used as "Absence Indicator"

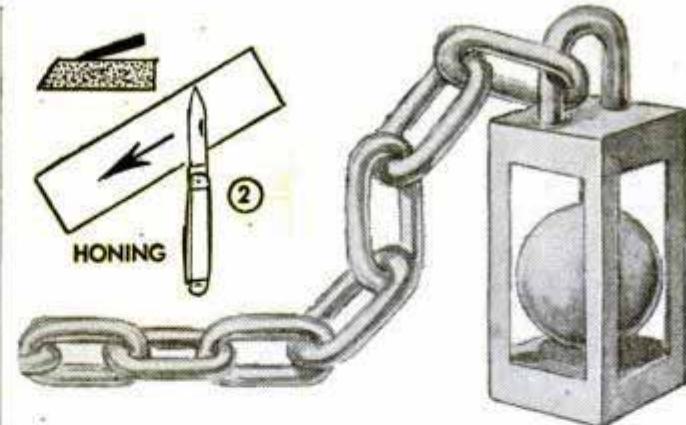
Shopkeepers and others who work alone can hang up an "absence indicator" like the one shown and thus save themselves the trouble of writing notes to explain their whereabouts. The indicator consists of a piece of stiff cardboard, a length of cord and a pointer. Two holes are punched in the cardboard, one near each end at one side, to take the cord. The pointer is made by threading the cord through the holes of a large button and over a narrow piece of wood, such as a matchstick, so that the button will slide. The ends of the cord then are inserted through the holes in the cardboard and knotted, and announcements are lettered on the board.

H. T. Gunderman, New York.

Easy Way to Open Oyster Shells

Oysters are removed from their shells easily if they are first immersed in carbonated water. The carbon dioxide in the water relaxes the muscles of the oyster and after about 5 min. the shell can be opened.

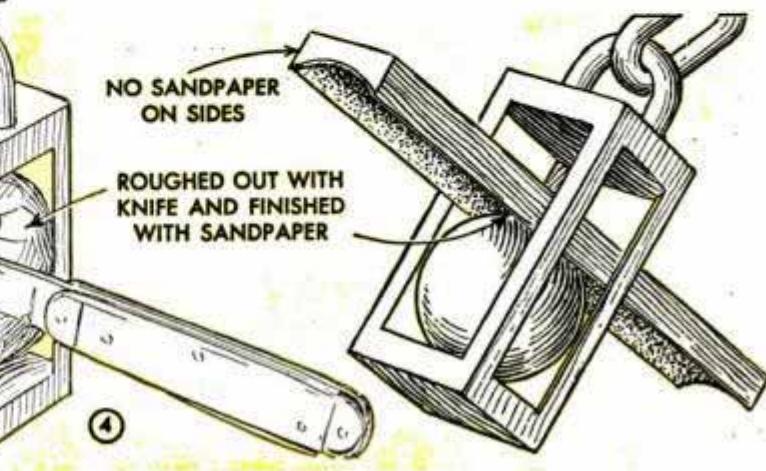
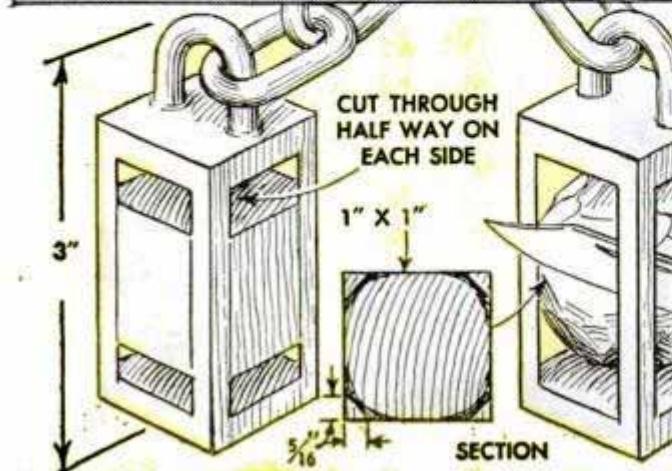
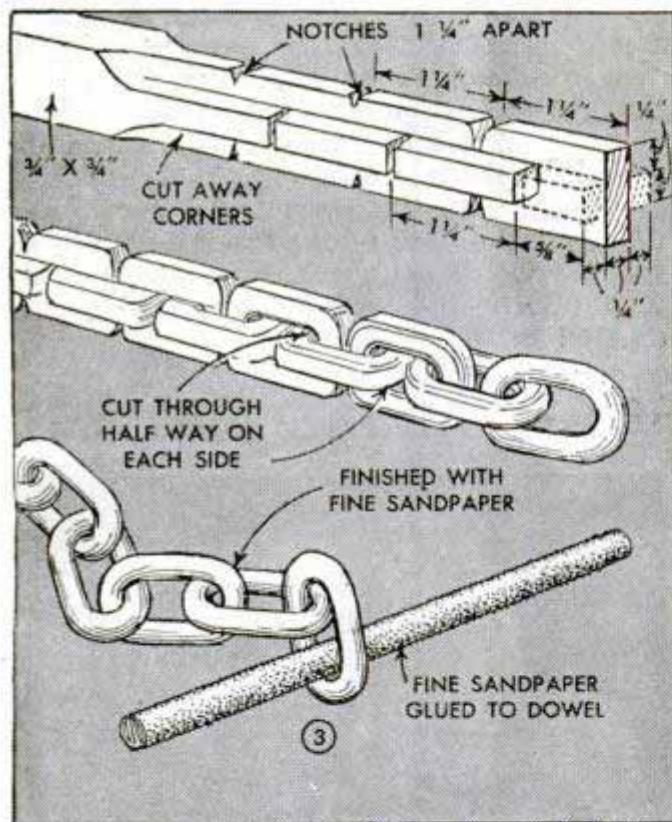




FUN WITH

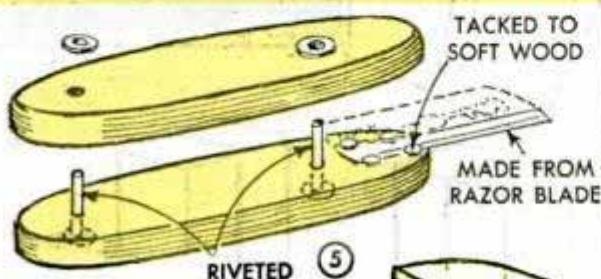
YOU can have a lot of fun whittling chains, caged balls, scissors and many other objects that seem difficult but are really quite simple if you have a keen-edged jackknife. The secret of good whittling is to keep your knife sharp enough to make clean cuts without breaking the wood. When honing a knife, it's best to use two grades of oilstone, medium and fine. Both sides of the blade are drawn diagonally across the surface of the medium stone with the back edge raised slightly as in Fig. 2. Do not use a circular, grinding motion. Then the blade is similarly sharpened on the fine stone. The "wire edge" which is a result of this honing can be removed by stropping as in Fig. 1 and the knife is ready to go to work.

To make the chain, Fig. 3, select a length of $\frac{3}{4}$ -in. square, straight-grained basswood or sugar pine, both of which are soft and do not split easily. First cut a $\frac{1}{4}$ -in. strip from each corner as indicated in the upper detail. Then check the accuracy of the piece by making a template of sheet metal which has the same shape as the end section. This is slipped along the wood and used as a "go" and "no-go" gauge. Notches are cut to make the links, which then are formed and rounded as in the center detail, Fig. 3. They are smoothed with a piece of sandpaper glued around a





A JACKKNIFE

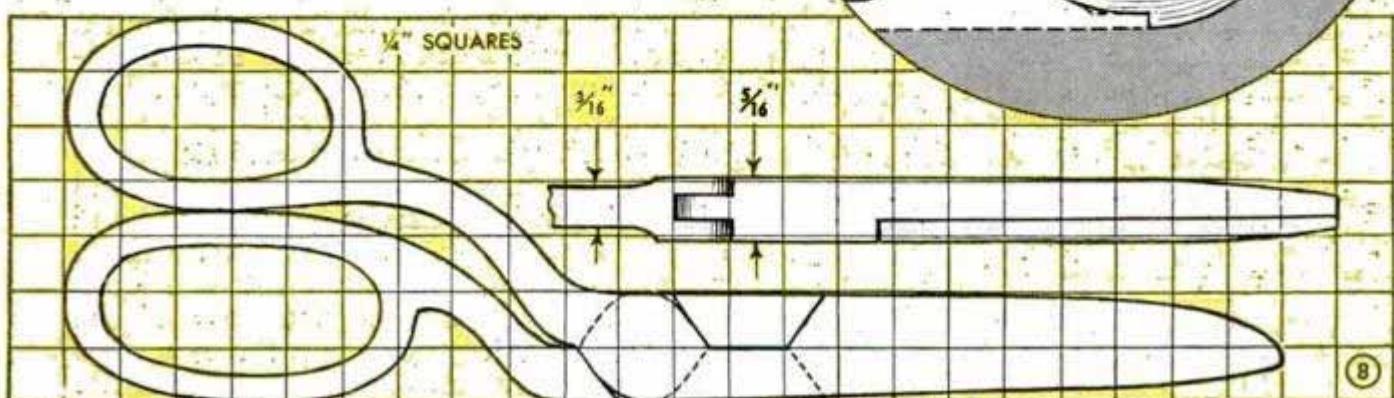
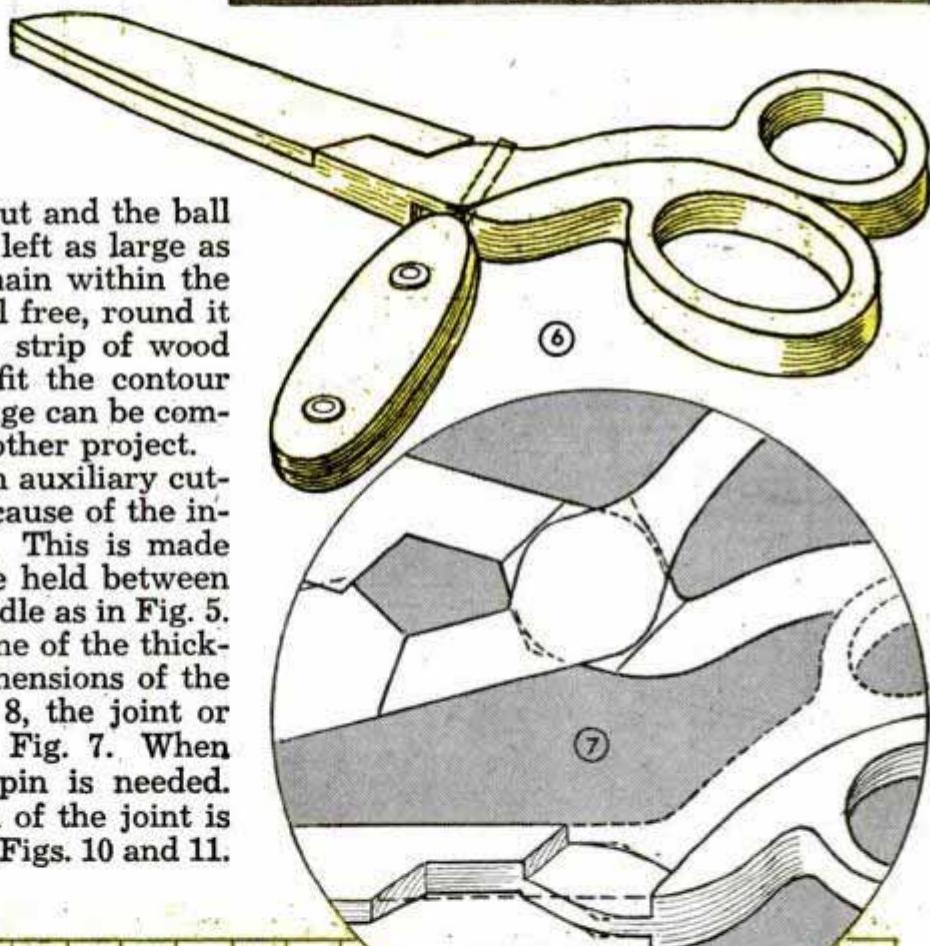


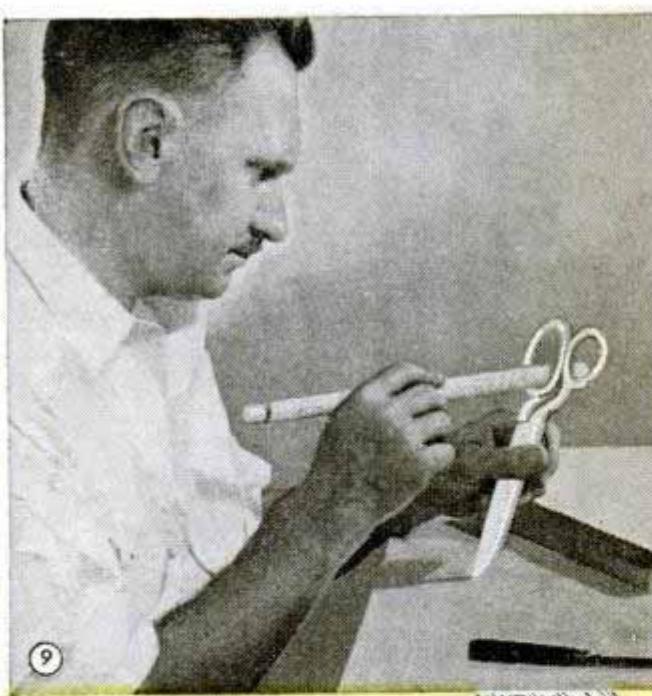
short length of dowel as indicated in the lower detail.

The ball-in-a-cage is made as shown in Fig. 4.

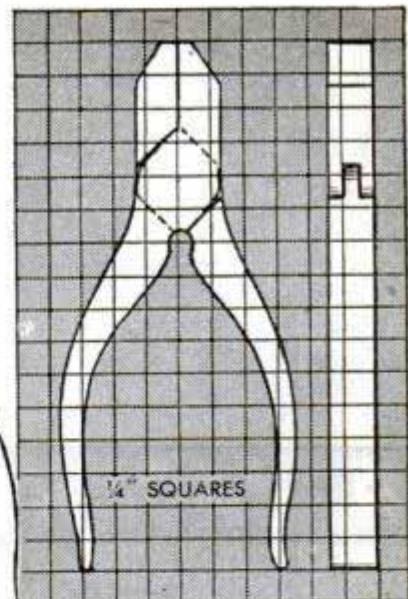
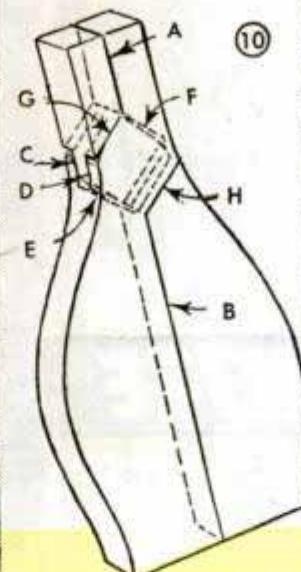
First the corner posts are cut and the ball is roughed out. It must be left as large as possible so that it will remain within the cage. After cutting the ball free, round it with sandpaper glued to a strip of wood having a concave face to fit the contour of the ball. The ball-in-a-cage can be combined with the chain as another project.

For the scissors, Fig. 6, an auxiliary cutting tool will be needed because of the intricate method of jointing. This is made from a piece of razor blade held between two halves of a wooden handle as in Fig. 5. Preferably this should be one of the thicker safety-razor blades. Dimensions of the scissors are shown in Fig. 8, the joint or fulcrum being detailed in Fig. 7. When made carefully, no pivot pin is needed. Opening and closing action of the joint is similar to that of the pliers, Figs. 10 and 11.

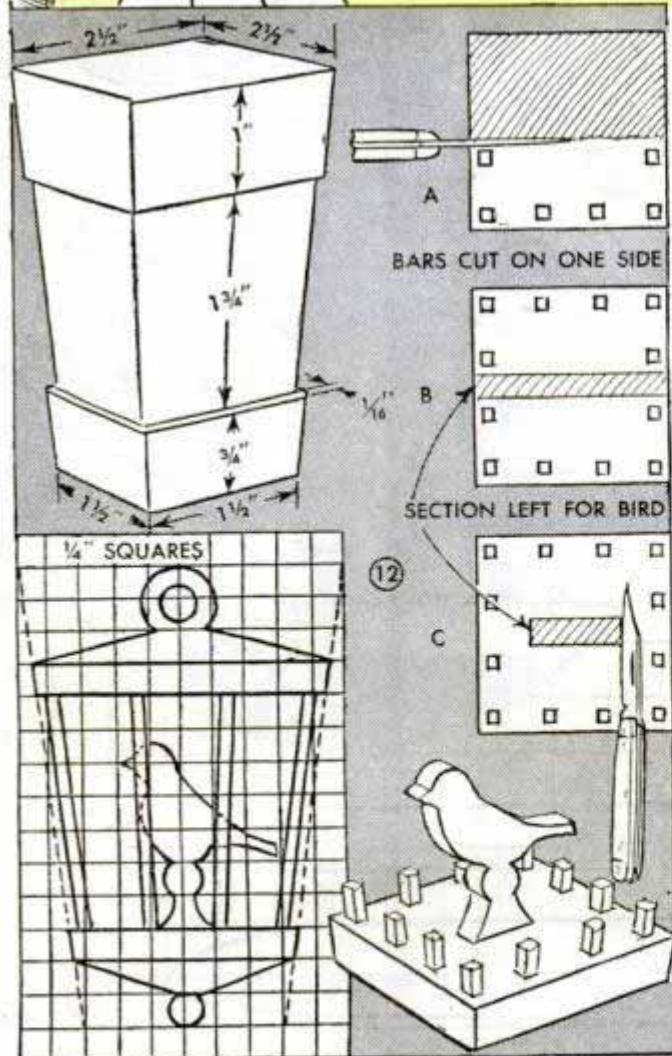
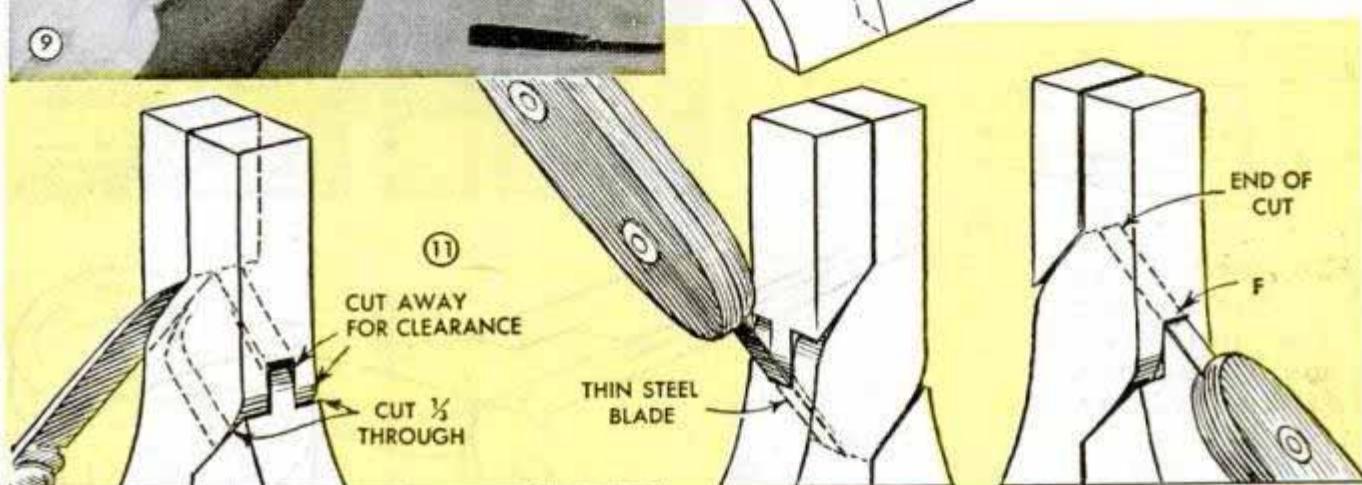




CUT THROUGH
CAREFULLY
AT A, B, C AND D



9

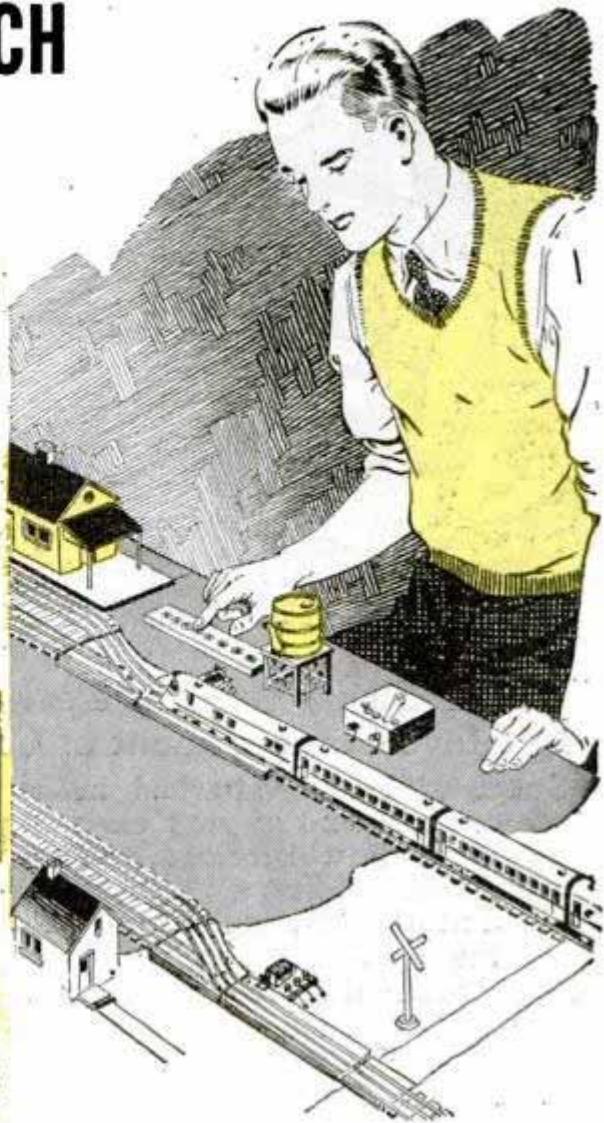
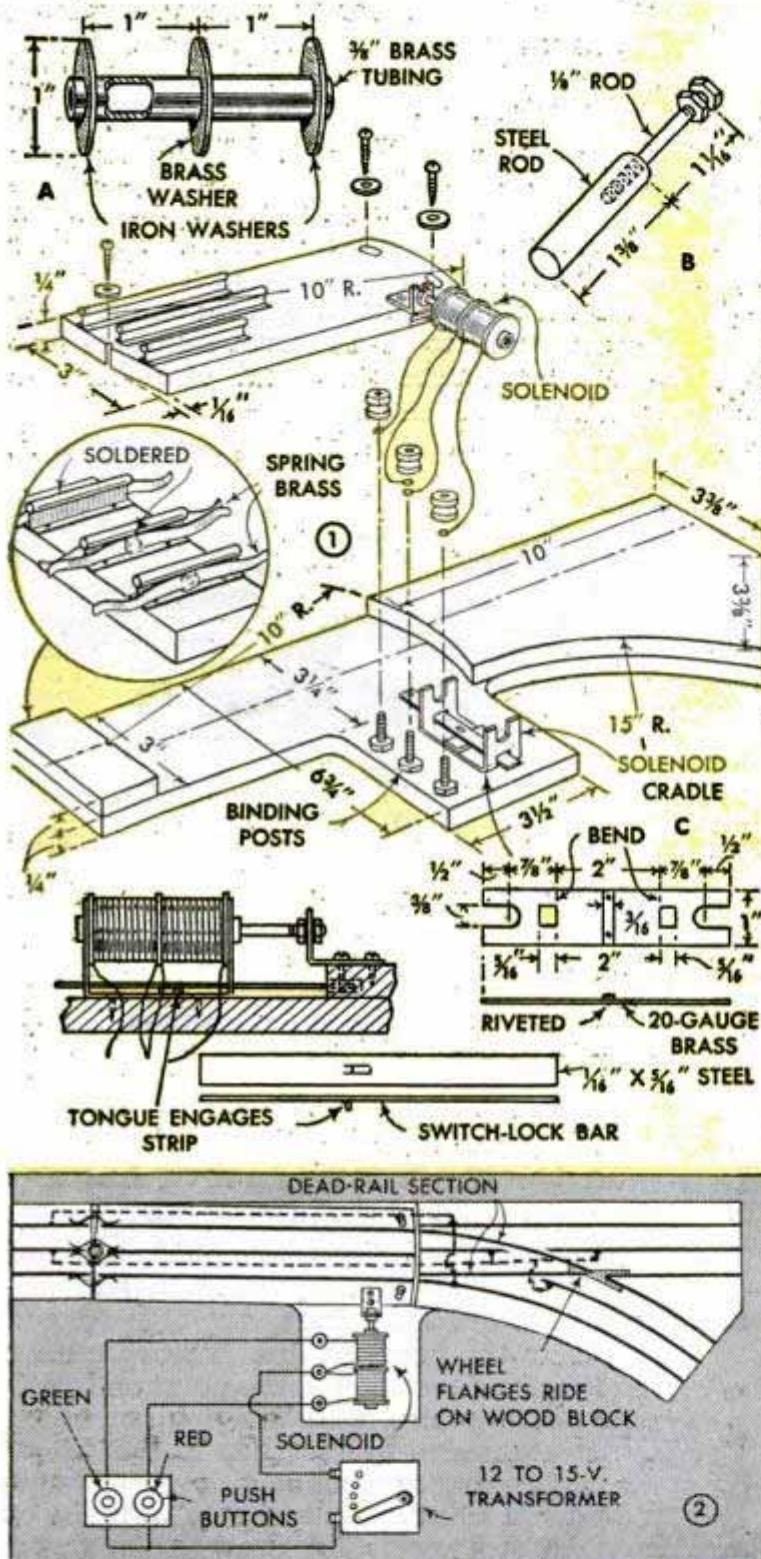


To make the pliers, carve them to the shape shown in the cross-hatched pattern, Fig. 10, and make cuts A, B, C and D all the way through. Then cut E to B and F to A, using the tip of the tool as in the center and right-hand details of Fig. 11. Cuts G and H are made about one third of the way through on both sides to leave a narrow strip joining the jaw with the handles. To prevent splitting the wood, cut but a little at a time. All diagrams must be followed exactly, as some of the cuts go only part way through the wood and, if continued, would spoil the piece. If the parts do not open readily, all cuts should be gone over again to ease the action. When the cutting is finished, the pieces can be sanded as in Fig. 9.

The bird cage, Fig. 12, is made from a tapered block that is recessed in the center portion as indicated in the upper left-hand detail. Bars are marked on all sides with pencil and then cut on each side leaving the central portion. The bird is carved to the shape shown in the lower right-hand detail. Cutting the bird will take some time as this must be done with the knife blade inserted between the bars of the cage. For variety, you can make a cage with five bars to a side, or you can whittle several animals in the cage.

REMOTE-CONTROL SWITCH

for model railways



or to dry batteries, which will give more silent operation. The switch is moved by pressing push buttons, Fig. 2, one painted red to throw the switch for the side track, and a green one for main-line traffic.

The spool of the solenoid, detail A of Fig. 1, is a piece of brass tubing to which washers are attached. It is wound almost full with 25-ga. wire, and a plunger, detail B, is made to fit the tubing. The solenoid is held in a brass cradle, detail C. When power is applied, a magnetic field is created to move the plunger—which is attached to a track section—and lift the locking bar over the raised strip at the center of the cradle. When the current is shut off, it drops down with its tongue on the side of the strip. The track is bradded to a wood base, the switch section being held on a wood screw located at one end of the center rail. Spring clips soldered to the ends as indicated in the circular detail hold the current across the joint while permitting free action of the switch. The two ends of the center rail encircle the pivot.

UNLIKE most switches for model electric railway tracks, this one, which is remotely controlled, moves a section of straight track to meet the switch. It has no sliding metal plates, no frogs and no parts that clatter when a train passes over it. The switch is operated without auxiliary levers by a double-acting solenoid, the electric current being supplied independently of the train circuit. For instance, the solenoid can be wired to the posts of the circuit transformer, to a separate transformer,



Dating Stamp for Concrete Work Utilizes Old License Plates

When laying sidewalks, driveways or platforms, you can print the date of completion in the concrete with this stamp, which utilizes outdated auto-license plates of the kind that have raised numerals. The numbers are cut from the plate and nailed to a wood block with the reverse side up. White-lead putty is used for filleting around the outer edge of the numbers. As an alternative, house numbers or any other numbers that have been pressed out of sheet steel can be used. These stamps could also be used to press street numbers into sidewalks, curbstones and elsewhere to furnish identification.

John A. Benke, Buffalo, N. Y.

Leather Strips Used as Pockets In Glove Compartment of Car

Strips of leather attached inside the glove compartment of your car will provide pockets in which maps, pencils, bottles of lotion and first-aid medications can be held neatly. The pockets not only will keep the articles where they may be reached without searching, but will hold bottles upright and prevent them from spilling. The strips are wired in place, holes being drilled in the walls for the wire. If desired, a large hole can be cut in one of the walls to take paper drinking cups.

Thos. E. Stimson, Jr., Los Angeles, Calif.

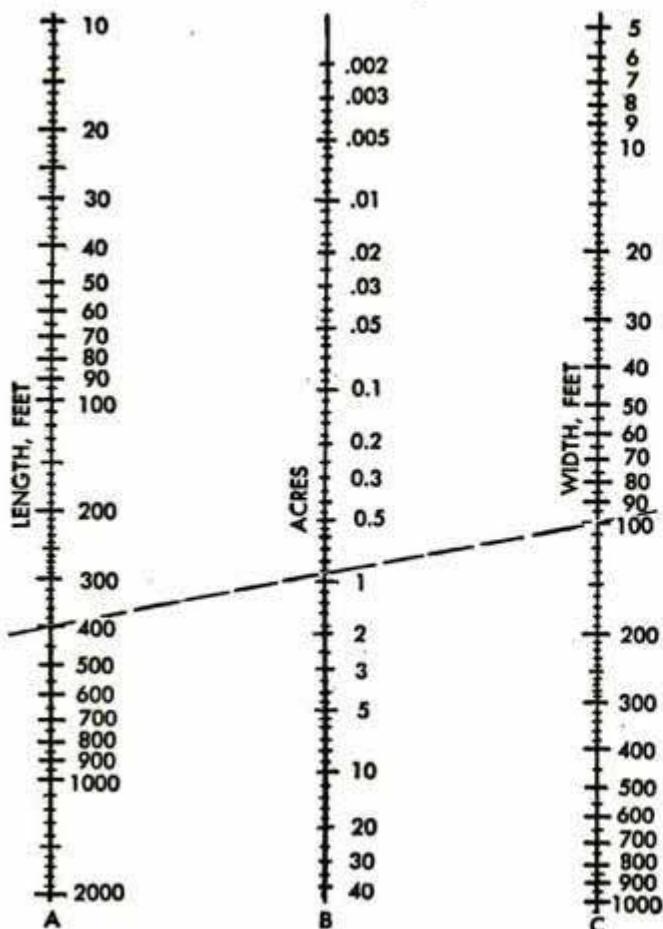
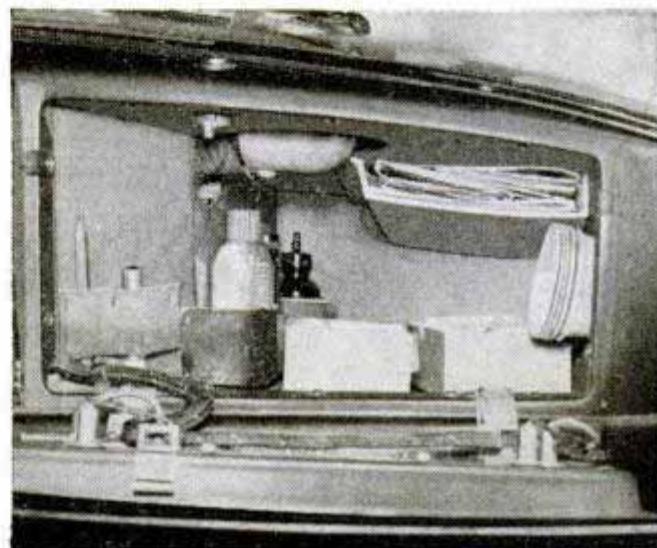


Chart Computes Number of Acres In Rectangular Tract of Land

With this chart you can tell the approximate acreage of any rectangular tract of land if the length and width in feet are known. To use the chart, a straightedge is laid from the point on line A representing the length of the tract to the point on line C representing the width. The point at which the straightedge crosses line B will show the approximate number of acres contained. In the example shown, a piece of land 400 ft. long by 100 ft. wide contains a little over 0.9 acres, or about 0.92 acres. For areas over 2000 ft. long, length measurements can be expressed in terms of hundreds of feet instead of thousands, and the figure found for the acreage multiplied by ten. An area 4000 ft. long by 100 ft. wide will contain about 9.2 acres. Similarly, if the tract is 4000 ft. by 1000 ft., the figure in line B is multiplied by 100 so as to read 92 acres, the decimal point being moved to the right as many places as there are ciphers added in lines A and C.

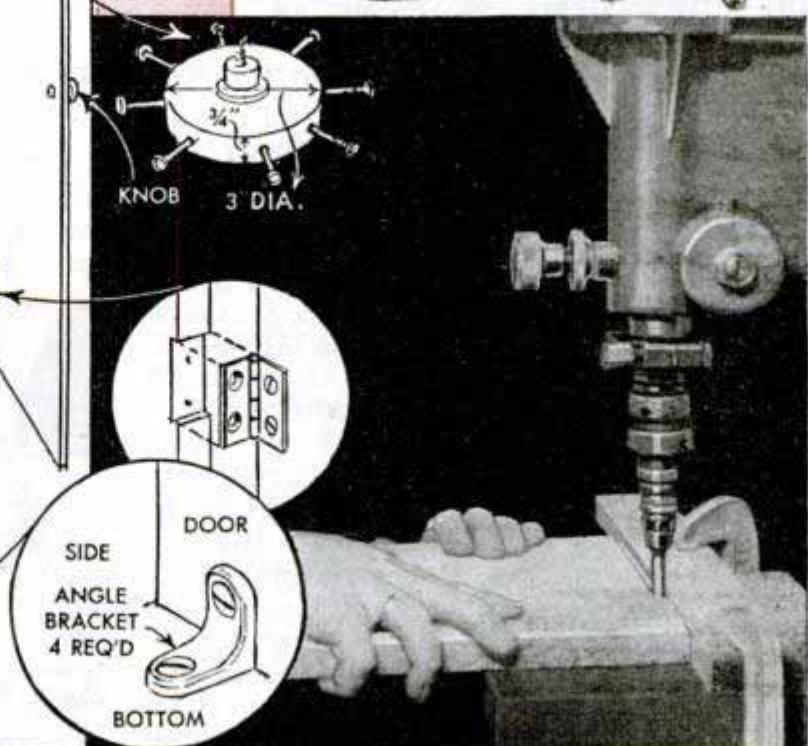
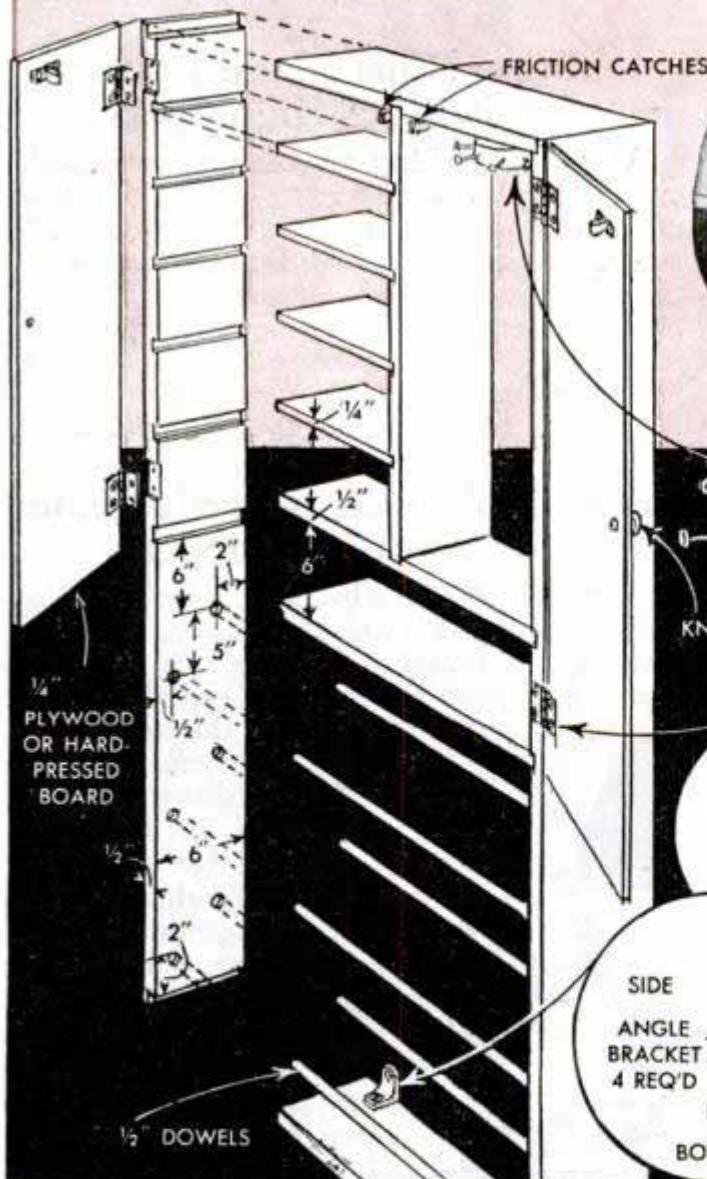
W. F. Schaphorst, Newark, N. J.

ON-A-DOOR CABINET

Saves Space

FOR those who live in small apartments, this clothes cabinet, which is attached to the inner side of a door, will increase storage space and permit shoes, ties, linens and similar articles to be stored neatly within easy reach. The cabinet frame is made of $\frac{1}{2}$ -in. stock cut to fit a door, and is grooved for shelves and a partition as shown. Staggered holes are drilled in the side members of the frame to take lengths of dowel, which form shoe racks, and the ends of the members are rabbeted for top and bottom pieces. Flush doors of $\frac{1}{4}$ -in. plywood are provided with friction catches and glass knobs. A wooden disk and a spacer made by cutting a spool in half are screwed into the underside of the top to hold ties, nails being driven into the edge of the disk for this purpose. When assembled and finished as desired, the cabinet is attached to the door with angle brackets screwed to top and bottom pieces.

Newell D. Hartley, Devon, Conn.



Markers and Holder Save Time In Locating Papers



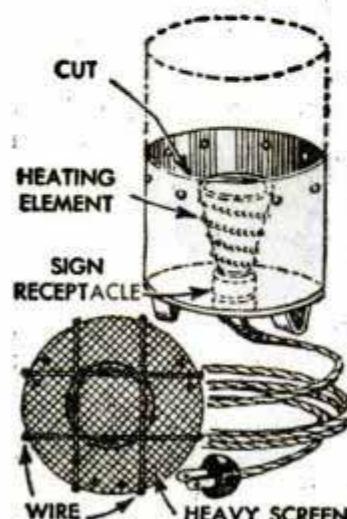
When a file has been removed from a filing case, time frequently is lost replacing the folder in its proper place. As an aid in locating the place for the "out" file these markers are used. They can be cut out of cardboard, a little longer than the height of the file, and labeled with the name of the person who is using the file. A holder such as the one shown can be made of plywood.

Tape Secures Cork in Bottle

When packing your bag for traveling, one way to make sure cosmetic bottles will not spill is to put a strip of adhesive tape over each cork or stopper and run it an inch or more down each side. After that the bottles will take any amount of jarring without danger of spilling.

Vincent A. Otto, Baltimore, Md.

Hot Plate Is Made From Tin Can And Heat-Lamp Element



Using the element from a heating lamp, you can improvise a hot plate in a short time almost entirely from scrap materials. The heating element is screwed into a sign receptacle to which a cord and plug are attached, and the receptacle is fitted over a hole in the bottom of a

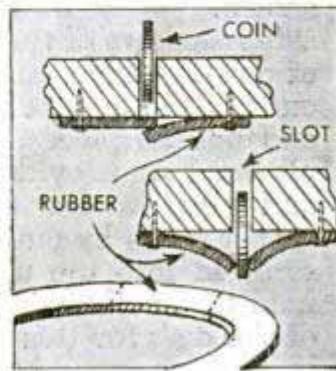
large tin can. This is cut down so that its edge extends for a short distance above the top of the element, and holes, spaced as shown, are punched in the edge of the can for lengths of heavy wire that support a grate. Strong screen wire or mesh, cut to fit inside the can, is used for this purpose. For legs, electric-cable straps are attached to the can with bolts.

Kenneth C. Colby, San Francisco, Calif.

Strips Over Slot in Child's Bank Prevent Removal of Coins

Fastened on the underside of the cover of a child's wooden bank, strips of rubber will prevent coins from falling out when the bank is inverted and shaken. Strips of inner-tube rubber or cannning-jar rings are nailed on the cover so that they overlap the coin slot.

Philip C. Birnbach, Jr., Brooklyn, N. Y.



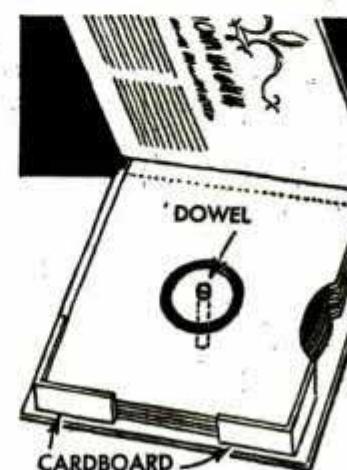
Wringer Rolls Made Efficient By Sanding High Spots

Usually, washing-machine wringer rolls will wear down most in the center because that part receives the hardest usage. Almost new efficiency can be secured by removing the rolls and sanding the high spots on each end with coarse sandpaper. To check the alignment for maximum contact, rotate the rolls against a straightedge.

Floyd Bushnell, Berkeley, Calif.

Bracing Protects Record Album While Being Shipped

With a little extra bracing, record albums can be shipped without damage. A small dowel is trimmed to fit the center hole and extend beyond the records on both ends.



For the unprotected corners, corrugated cardboard is cut the same width as the length of the dowel, bent at right angles and inserted between the covers. The album then can be wrapped and shipped.—Lt.(j.g.) Frank L. McKibbin, Key West, Fla.

18" Model of

OVERLAND STAGECOACH

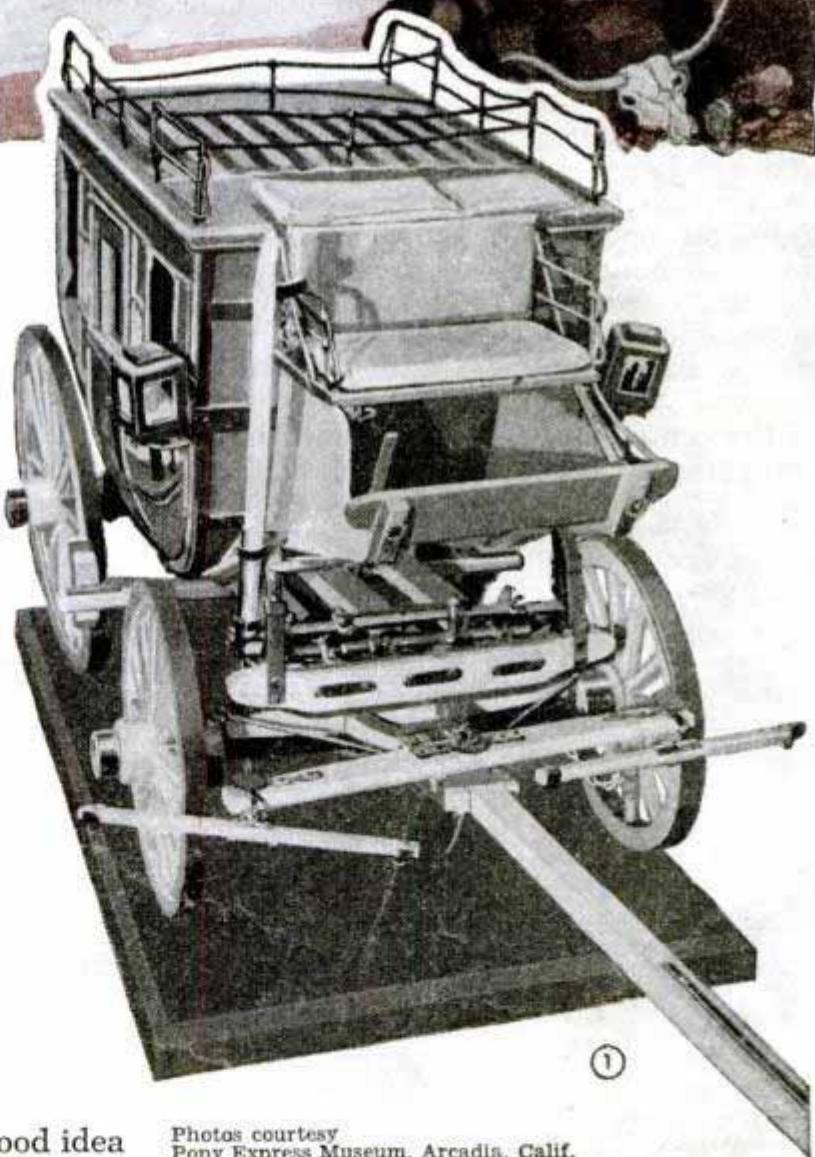
X437A



By Hi Sibley

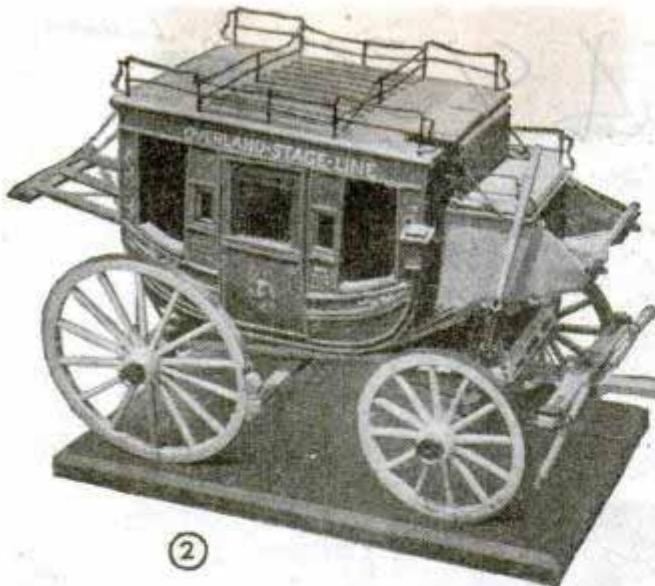
HANDSOME in a rugged way, with bright yellow running gear, red coach body decorated with gilt striping and outdoor scenes painted in oil on the door panels, the prototype of this coach model weighed a ton and a quarter empty and cost nearly \$2500. Noteworthy features of these old overland coaches were the exceptionally heavy running gear and the unique method of springing the body as shown in Figs. 7 and 9. This particular coach was one of several owned by the "Overland Stage Line" which followed the pony express route between St. Joseph, Mo., and Sacramento, Calif., a service that was operated on regular schedules until the completion of the first transcontinental railway. Ben Holliday, whose name appears on the door panel of the old coach, was a division superintendent of the Overland Line.

Figs. 1, 2 and 6 will give you a good idea of the general appearance of the finished model. Construction begins with the body, component parts of which are shown in Fig. 3. The overall size of the body is easily determined by laying out full-sized patterns from the crosshatched views in Figs.



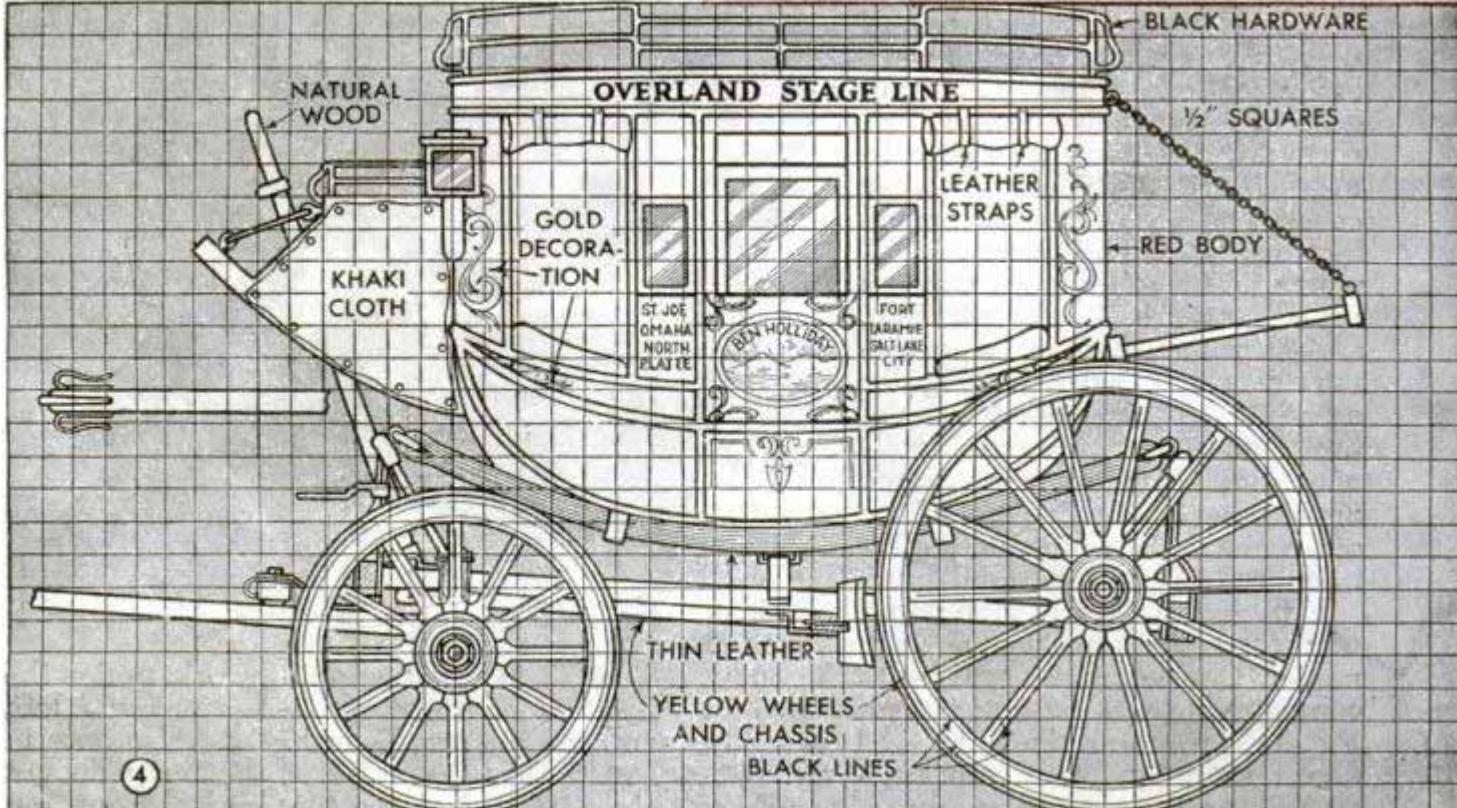
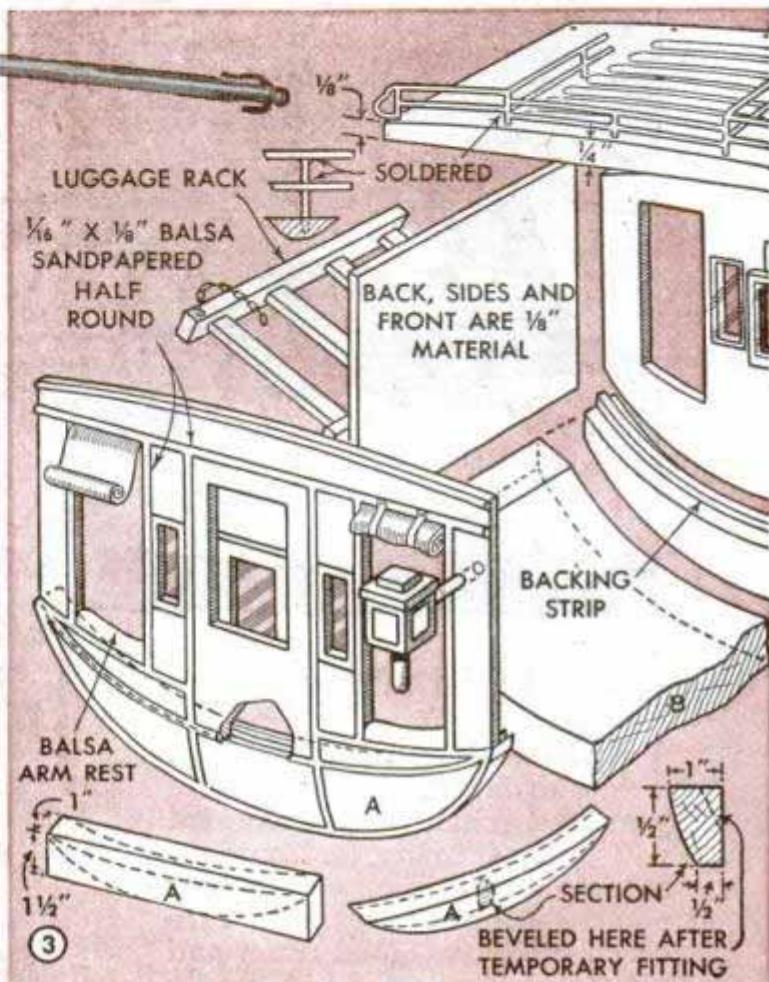
Photos courtesy
Pony Express Museum, Arcadia, Calif.

4 and 5. Before beginning work, notice the position of the parts A-A, right and left, and the bottom, B, in Fig. 3. Also note in Fig. 5 that the sides of the body do not slant inward at the top. Sides, front and

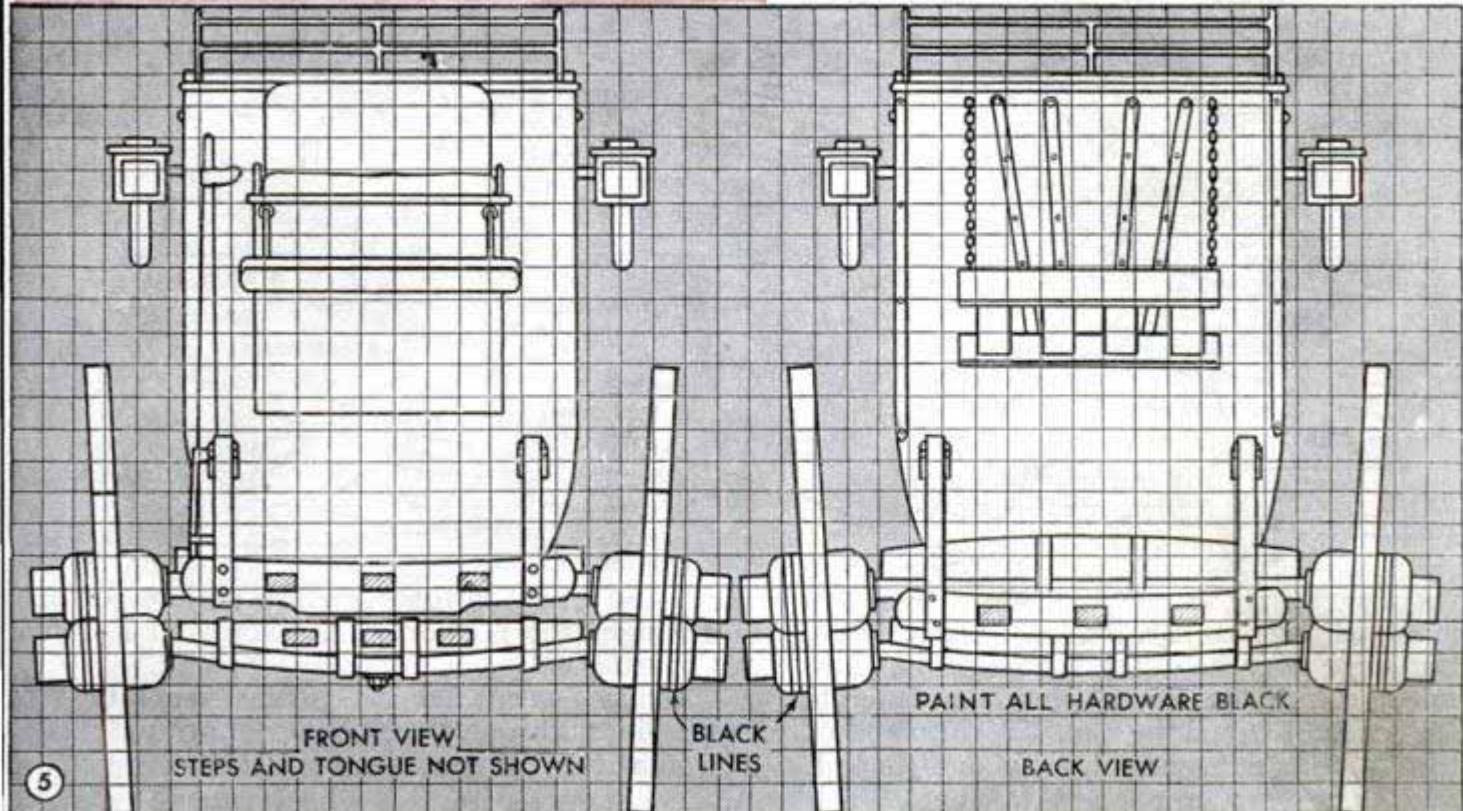
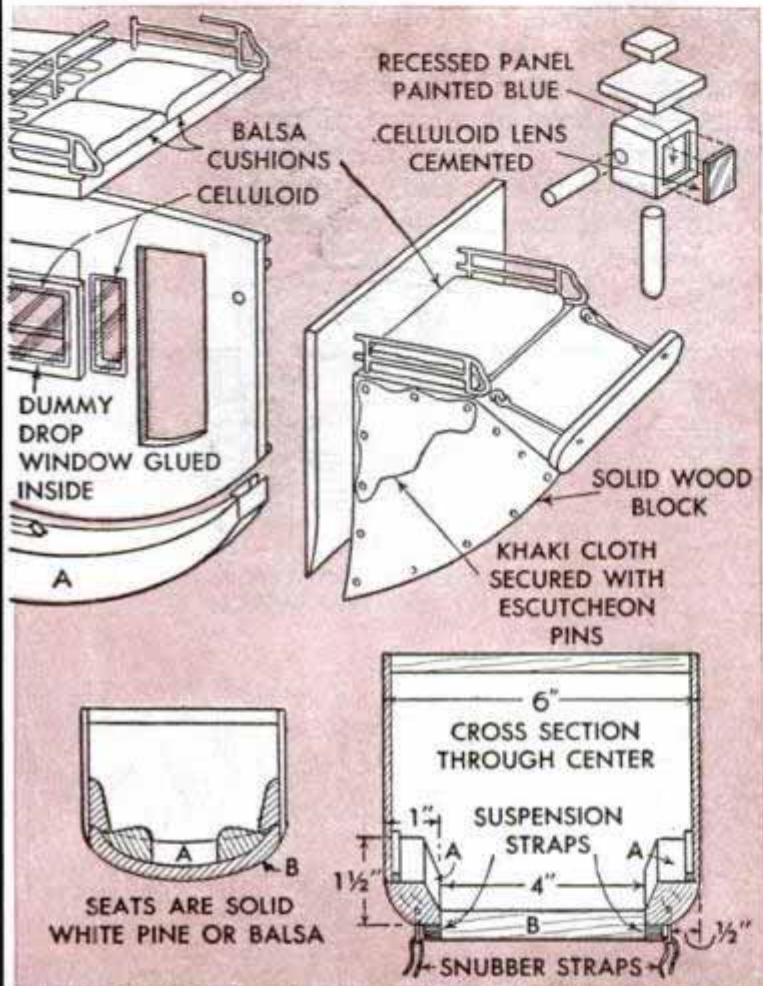


back parts of the body should be cut from $\frac{1}{8}$ -in. plywood, preferably a close-grained wood such as birch. Window openings are cut as indicated, and the doors are outlined with a molding made by sandpapering thin strips of balsa wood or rattan to a half-round section and gluing in place. Note that the doors each have a single sash, partially lowered and fitted with a celluloid light. The sash frame is glued to the inside of the body panel. The two small windows, one on each side of the door, have celluloid lights but no frames, while the large windows on both sides are merely openings curtained with khaki cloth rolled up as indicated and secured with thin leather straps. In assembling, begin with the bottom and glue the curved side pieces A-A to the center piece B, Fig. 3, and then fit and glue the sides and ends in place. Inside

seats are carved from balsa wood or white pine and glued to the sides and bottom of the body as shown in the cross section, Fig. 3. Then the top is glued on and shaped to the curves indicated. Assembly of the luggage racks, top and rear, and the fitting of the driver's seat and "boot" finish the body ready for the final sanding and application of the trim molding.

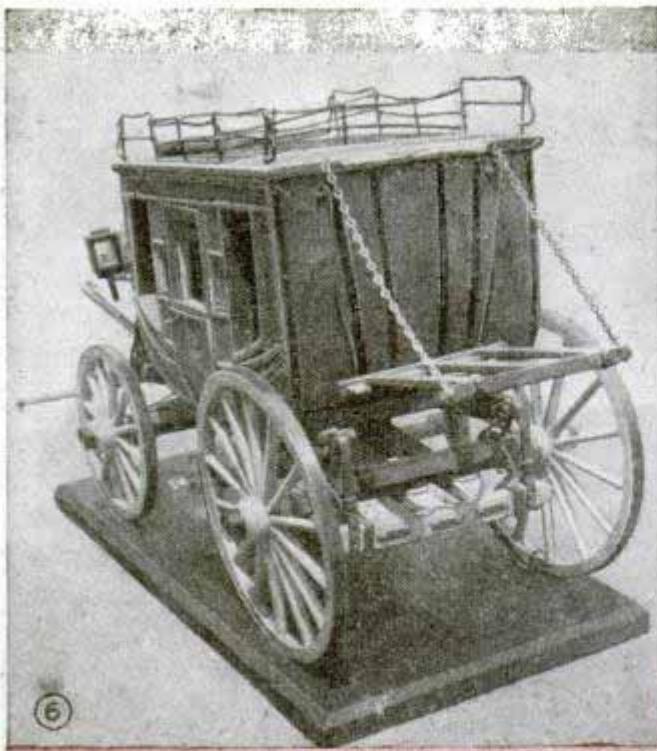


Next comes the running gear, the frame being detailed in Figs. 8 and 9 and the wheels in Fig. 10. The latter are the trickiest of all to make as close duplication of a number of parts is required. First, make the longeron, or spring unit, which consists of three lengthwise members mortised through end pieces as in Fig. 9. Note that the longerons slant to the rear, making the

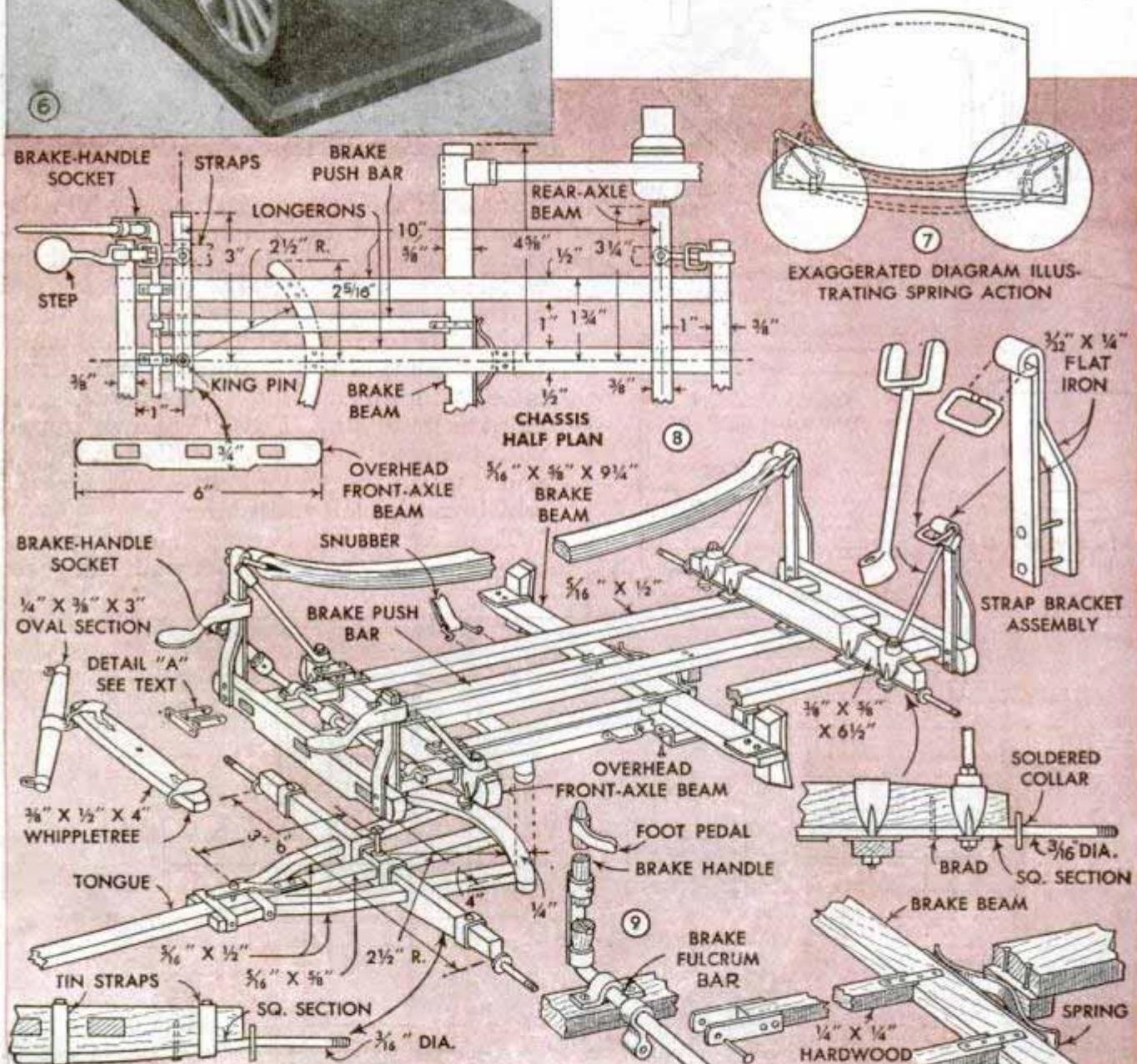


front axle the "overhung" type while the rear axle is of the conventional "underslung" construction. Use maple for all the wood parts. Sheet metal of 16-ga. thickness and wire of approximately the same diameter will serve in making most of the "hardware." Some of the "ironing" can be simulated by merely coating the area with black paint as in detail A, Fig. 9. Follow through with the construction as detailed in Figs. 8 and 9 up to the whippetrees and tongue, which can be left until later.

To make the wheel rims glue two pieces of $\frac{3}{16}$ -in. hardwood together with the grain



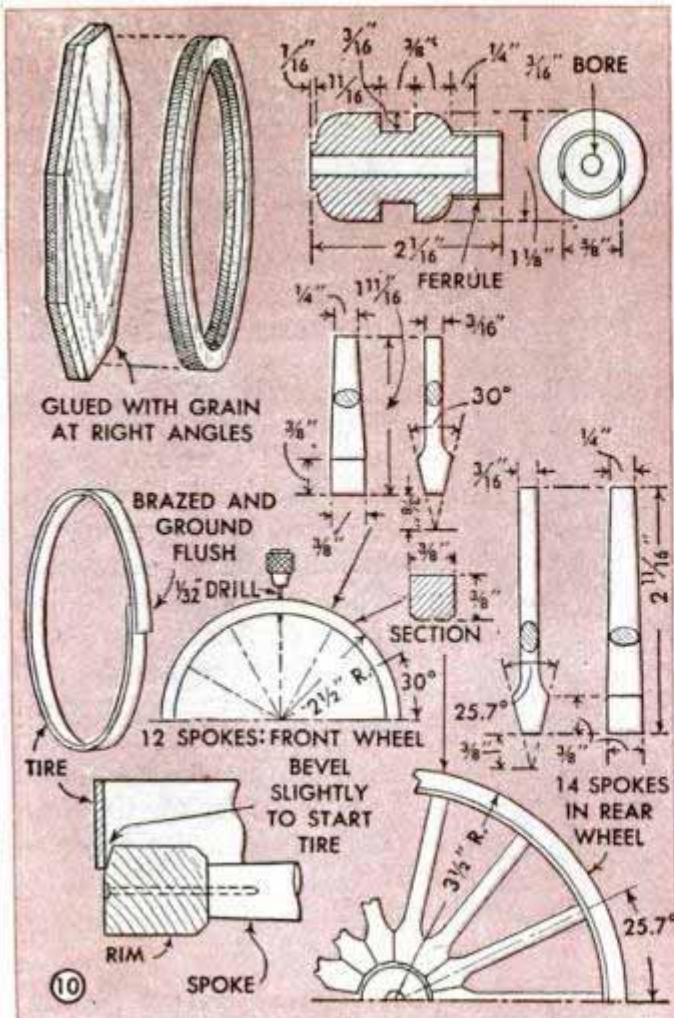
spoke with a template to assure uniformity. Blanks for the spokes should be cut slightly oversize and about $\frac{1}{8}$ in. longer than the finished length. After shaping, they are cut to exact length. Wheel hubs are turned to the dimensions given and fitted with a metal ferrule, after which a hole is drilled in the small end of each spoke to take a single brad. Before gluing the spokes into the hub a trial assembly is made of each wheel. With correct fit assured, glue the spokes into the hubs, trial-fit the wheel rims and glue and brad these in place. Make sure that the spokes are uniformly spaced on the rim and, before the glue dries, slip the wheel on the axle and check for true running. If the rim is out at any point,



running at right angles. Scroll saw the rims to finish size, or, if a lathe is available, the rims may be turned accurately. The wheel spokes are of oval section and slightly tapered toward the rim. The hub end of the spoke is flat tapered, or wedge-shaped, and it is very important to check each

clamp the wheel to the edge of a table top and weight the portion of the rim that is out of true.

The tires are cut from 16-ga. sheet metal to a $\frac{3}{8}$ -in. width and are bent cold around a circular form of the same diameter as the outside diameter of the wheel rim. The



ends of the tire are overlapped $\frac{1}{2}$ in. and the joint is brazed and ground flush. Edges of the tire are then rounded slightly with a file and smoothed with fine emery cloth. Before shrinking the tire on the wheel rim see that the latter is smooth and true and beveled slightly on the inside edge. Then heat the tire at several points and force it carefully over the rim. If necessary use several small C-clamps equally spaced about the rim.

Paint the running gear before assembling the body and gear. A neat job of painting always emphasizes fine workmanship and on work of this kind most model-makers use tinting colors ground in oil for the primer. Some craftsmen even go so far as to assemble the job completely for trial fit of all parts, then disassemble and paint each part separately. This method assures a paint job of professional quality. Most of the easily detached hardware and the smaller wooden parts of the running gear can be dipped in the paint and hung to dry on a wire or separate hooks. In any case continue dipping the parts until three coats of paint have been applied in this manner. For dipping, the paint should be thinned to a priming-coat consistency. Allow the excess paint to drain back into the container before hanging the part to dry. Be sure that you use a prepared thinner recommended by the manufacturer of the

paint. Of course, on this particular job it is not practical to disassemble the body for dip-painting. Follow Figs. 3 and 4 and use colors ground in oil or sign-painters' colors and apply with small round brushes, taking great care on the flat surfaces to lay on a thin uniform coating. Seats and interior are painted a medium brown to simulate khaki-colored upholstery and body lining. Pick up any excess paint in the corners and at the edges with an extra dry brush and carefully smooth out any laps or sags that may develop on the vertical surfaces. Allow each coat plenty of time to dry thoroughly, and before painting any parts on which an acid-soldering flux has been used, Fig. 11, neutralize the acid by washing the parts in hot water.

After the last coat of paint has had time to dry assemble the running gear and mount the body. Then make and fit the lamps, Fig. 3, and the tongue and whipple-trees. Dip these parts in paint successively in the same manner as described and allow to dry before fastening them permanently in place. If you do not feel equal to the lettering and the fine-line striping on the wheels it's a good idea to obtain the services of a sign painter. However, the landscapes on the door panels can be cut from duplicate colored illustrations and pasted on.

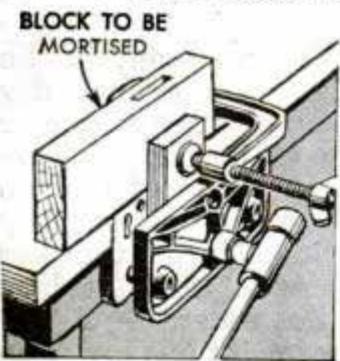
The model should be mounted on a base as shown in Figs. 1 and 2. The base adds considerably to the attractiveness of the model and helps to safeguard it from damage. Attach the model permanently to the base with small metal clips bent to the shape of the wheel rims and fastened to the base with small screws. Stain and finish the base with spar varnish.

Stovepipe and Fan in Fireplace Warm Room by Circulating Air



By installing a few lengths of 6-in. stovepipe in a fireplace and setting an electric fan to circulate air through it, an entire room of a cottage will be heated uniformly. Such an arrangement is ideal in cottages that are occupied only a part of the year, as it replaces a stove. Also, this method of warming a room will save fuel because it utilizes the heat of the fire before it is drawn up the chimney. The stovepipe is assembled as indicated in the detail and is located so that the flames will pass behind and in front of it. The fan is supported on a metal chair or stool and blows the air through the pipe into the room.—R. O. Leavenworth, M.D., St. Paul, Minn.

Clamping Fixture Holds Work For Hand Mortising

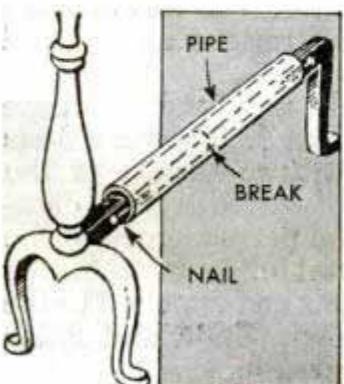


Damage to wood which is being mortised by hand can be reduced if the work is placed on top of the bench and clamped to a piece of wood held in a vise. The mortise is cut halfway through the wood, and the piece then is turned over to complete the cut.

W. R. Ellis, Kendall, Australia.

Pipe Repairs Broken Andiron

If the horizontal member of an andiron is broken, it can be repaired with a length of pipe. Select pipe that will slip over the broken ends with as little clearance as possible between the inside of the pipe and the andiron. To add rigidity to the joint, wedge nails into the ends of the pipe.—Allan S. Binns, Vancouver, B. C., Can.

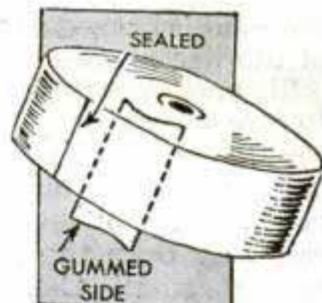


A fountain-pen cap with a hollowed out cork cover can be used to carry spare bicycle parts such as valve stems. It can be wedged into the seat post.—Rev. V. D. Elliot, Barsi, Sholapur Dist., India.

Tab Frees Gummed-Tape Roll When End Is Stuck

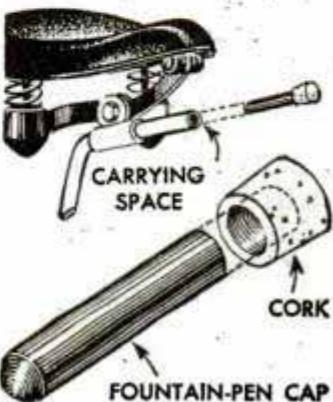
To prevent gummed tape from unrolling, it is an ordinary practice to stick the free end to the roll. However, this is not always satisfactory, since it is hard to free the tape, and cutting it may damage several thicknesses. One solution is to tear off a short piece and stick the gummed side of it to the gummed side of the roll a short distance from the end, then stick the free end to the roll. To loosen, pull the tab.

Pfc. Andrew Vena, New York.

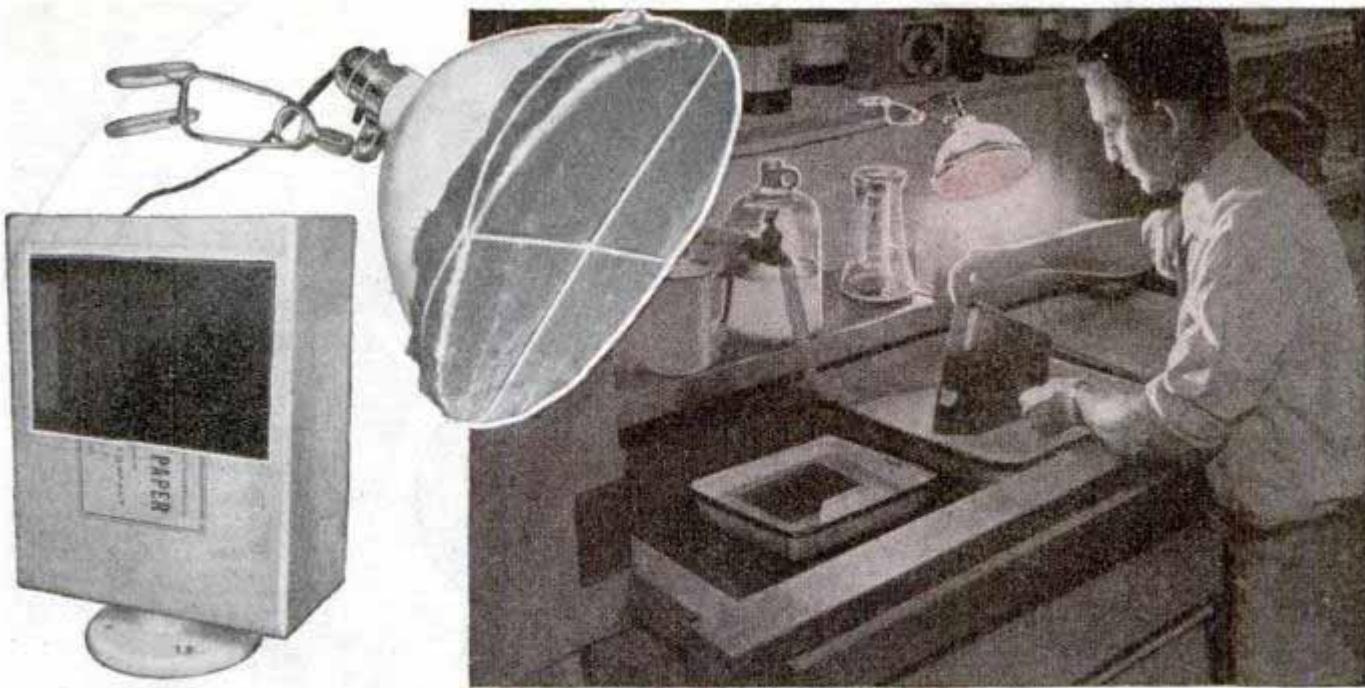


Spare Parts Carried in Pen Cap

A fountain-pen cap with a hollowed out cork cover can be used to carry spare bicycle parts such as valve stems. It can be wedged into the seat post.—Rev. V. D. Elliot, Barsi, Sholapur Dist., India.



Two Types of Improvised Darkroom Safelights



Using only a 10 or 25-watt amber or red electric lamp, a cardboard box and a porcelain socket with a base, you can improvise a safelight for your darkroom. A box like that in which photographic paper is sold will be suitable. Two openings are cut in the box, a large one in a side for emitting light, and another in one end just large enough to fit snugly over the socket. No paper need be pasted over the large opening if this is cut so as to leave enough of the side remaining to shield the lamp, as indicated in the left-hand detail. After

wiring the socket, the base is added and the "safelight" may be screwed to the work table or under a shelf.

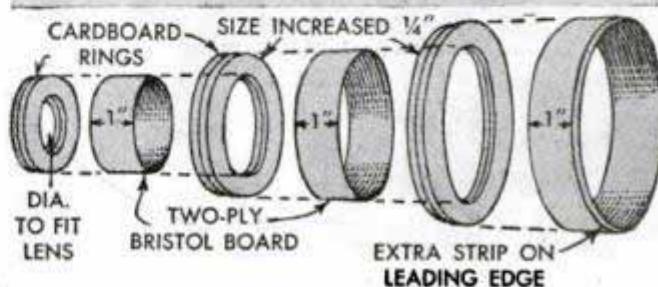
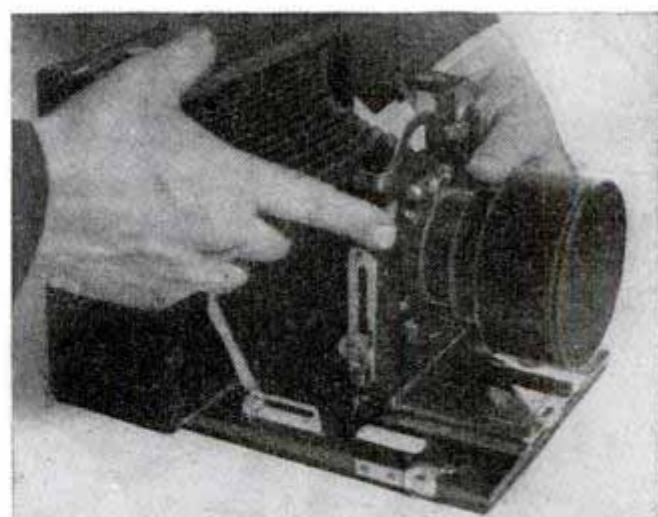
Another method of improvising a safelight is to substitute a similar lamp for the photoflood lamp in a reflector of the type having a pivoted clamp. Red or amber-colored paper is spread over the reflector and tied securely with cord across the front and around the reflector bowl. This safelight, being adjustable, may be clamped anywhere and tilted over the work.

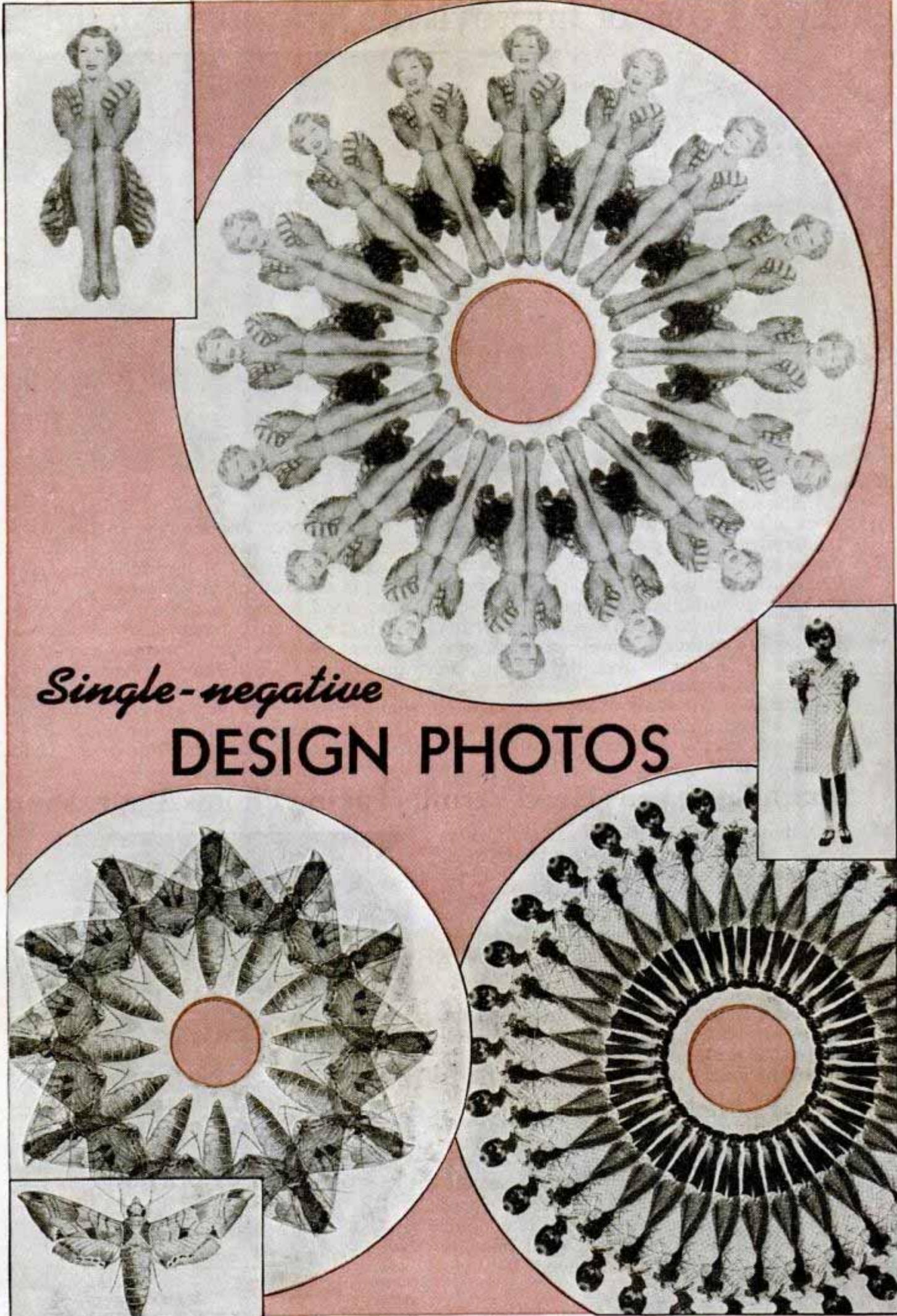
N. H. Berlin, Rosemead, Calif.

Extra-Long Lens Hood Permits Taking Photos Against Sun

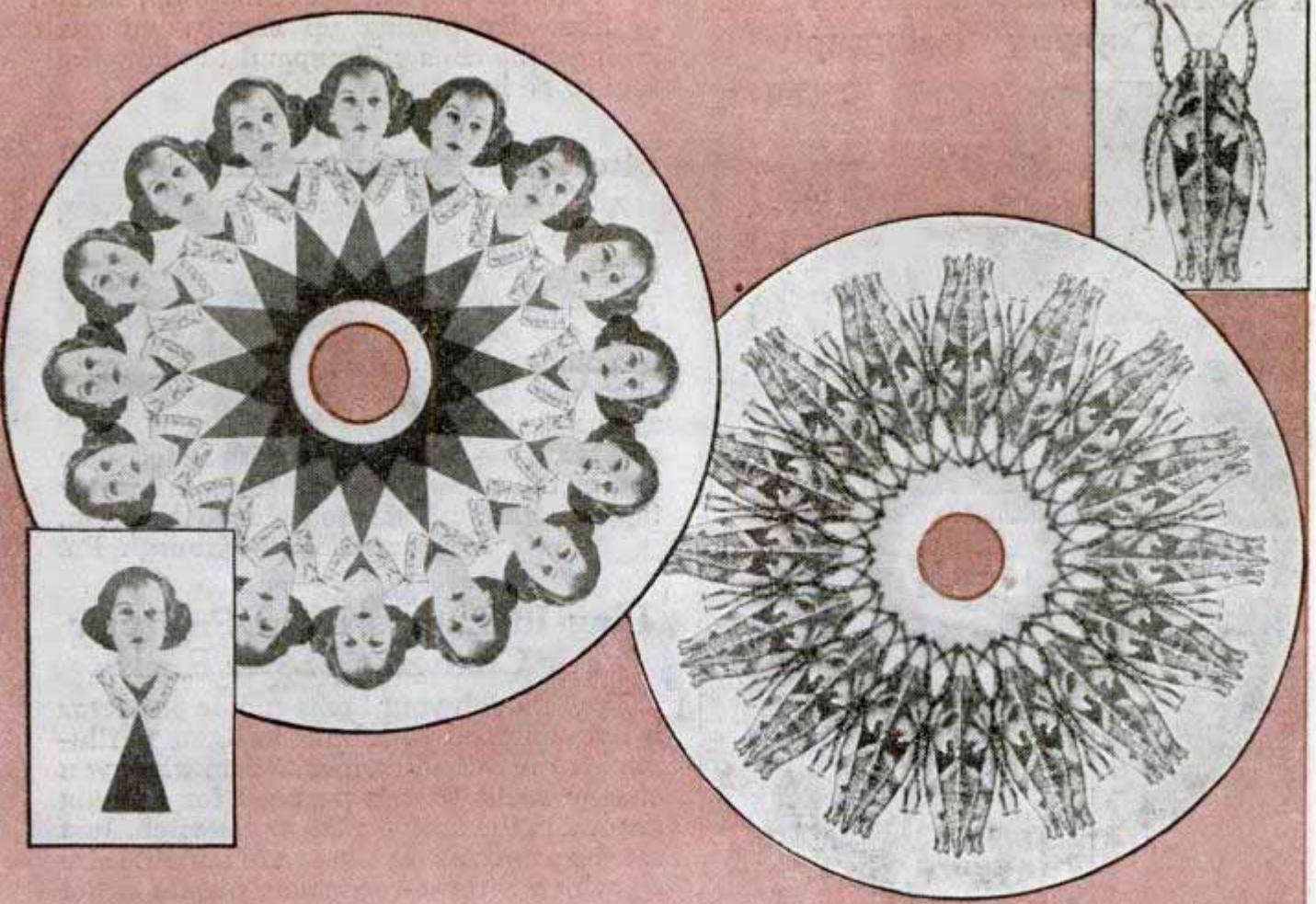
Of lighter weight than most metal lens hoods, this one, which is made of cardboard, extends far enough beyond the lens to allow the camera to be pointed almost directly into the sun if necessary. The hood is a composite of three smaller hoods, each consisting of two cardboard rings glued together with a strip of two-ply Bristol board attached around them for a rim, as shown in the detail. The first hood fits the lens mount, the second is glued over the rim of the first, and the third over the rim of the second. After the cardboard rings have been glued, they can be sanded for a more accurate fit, sanding the ring that fits over the lens only enough to make it snug. Feather the edges of the Bristol board where they meet to form a smooth joint. As reinforcement, an extra strip of two-ply board is glued around the edge of the leading rim. The completed hood is then painted flat black to prevent light reflecting into the lens.

R. M. Roland, Chicago.



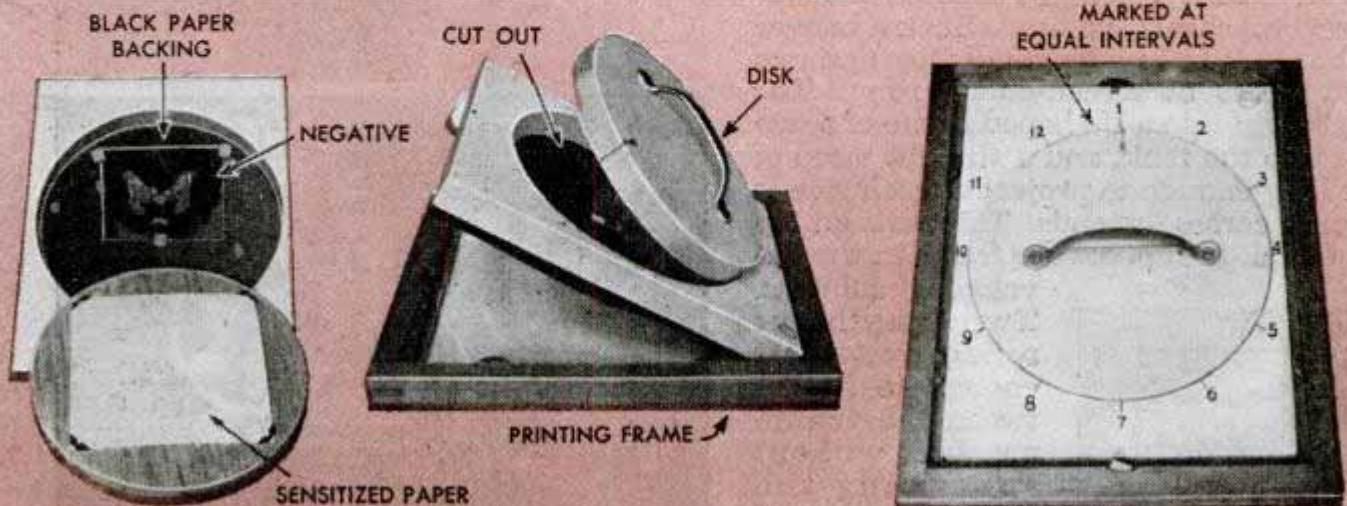


Single-negative
DESIGN PHOTOS

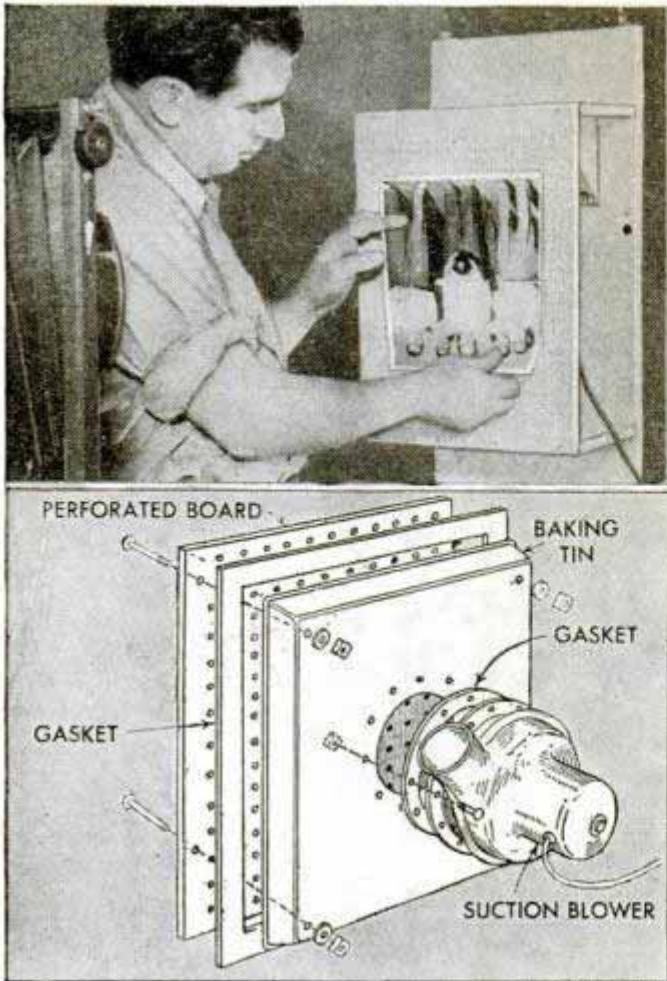


REPEATED exposures of a single negative on a squared sheet of sensitized paper gave the novel geometric patterns you see here. As the first step, the hinged back is removed from a standard contact-printing frame and a simple "indexing head" is fitted in its place. This consists of two parts, a fixture of $\frac{3}{4}$ -in. stock squared to fit the printing frame and a movable disk of the same material and thickness which fits in a hole scroll sawed in the wood fixture. The latter is indexed in twelve or more equal divisions. Sensitized paper is mounted emulsion-side up on the disk with art corners as shown. Then

an opening slightly smaller than the negative is cut in a sheet of opaque paper which is pasted on the printing-frame glass in the position indicated. Finally the negative is located off center and taped emulsion-side up on the opaque-paper mask. The first exposure is made with the index marks at the first graduation. Then the disk is rotated to the next mark for the second exposure, after which the process is repeated until the full number of exposures has been made. The negative should contain a single symmetrical figure and the exposures must be equally timed.—F. P. Roulland, Fresno, Calif.



Perforated Board Serves as Easel For Copying Photographs

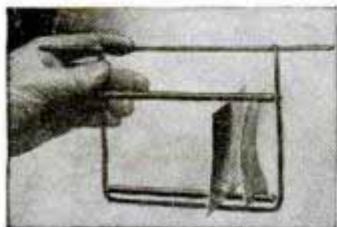


In copying work, one photographer supports prints on a perforated board where they are held by suction of air from a blower of the type used in vacuum sweepers. The blower is bolted to the bottom of a baking tin attached to the board and a cork or rubber gasket seals the edges of the tin.

Lyn Grover, Los Angeles, Calif.

Many Sheets of Pack or Cut Film Held in Wire Hanger

More than the usual dozen sheets of pack or cut film can be developed at the same time in a tank if hangers capable of holding several sheets are used. Such a hanger can be made from a length of wire and two short pieces of screen-door spring. The wire is bent into a U-shaped frame of a size to fit into the tank, and a straight piece of wire long enough to project at each side is soldered across the ends. This rests on top of the tank to support the frame in the developing solution. Two lengths of spring, just short enough to fit between the frame members without spreading the coils, are soldered



the required distance apart to hold a sheet of film. By pulling up slightly on the springs, the coils will expand to allow the film to be inserted.

Photo-Tank Temperature Control

A water jacket to keep the temperature of a developing tank constant can be made by coiling a length of rubber tubing around the tank



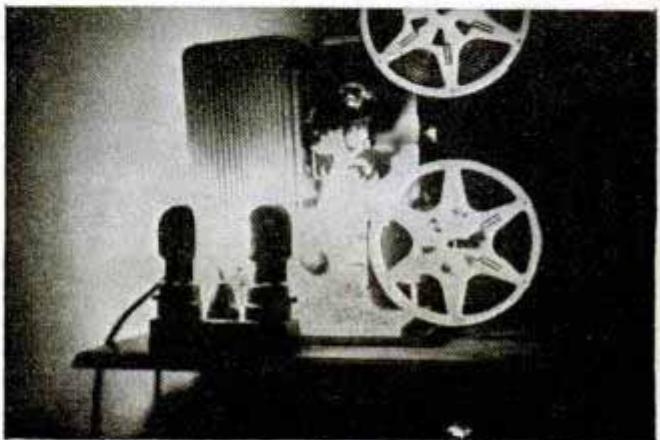
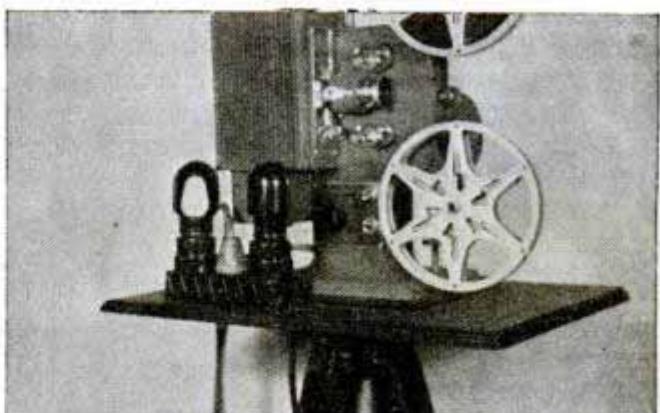
and tying the coil together with string. One end of the tubing is attached to the water tap; the other directs the water to the drain.

Herman Klein, Pittsburgh, Pa.

Plug-In Lamps Light Projector For Changing Movie Reels

Even though your home-movie projector is not equipped with built-in lights to illuminate the threading mechanism when you change reels, there's no need for groping around in the dark for the wall switch. Just set the projector on a board of suitable size on which a three-receptacle plastic outlet is attached as shown, and insert a cord from a wall outlet through a hole in the board to the receptacle connections. The auxiliary outlets will take the projector cord and two 7-watt snap-switch night lights, which will provide enough illumination on the projector for threading the reel.

L. H. Georger, Buffalo, N. Y.





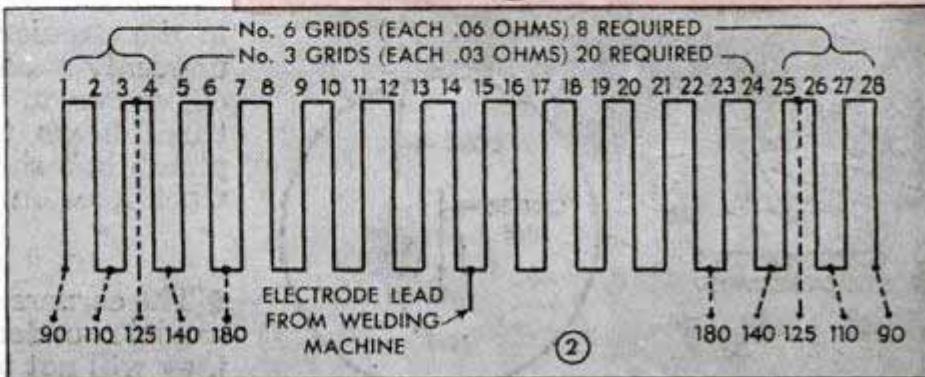
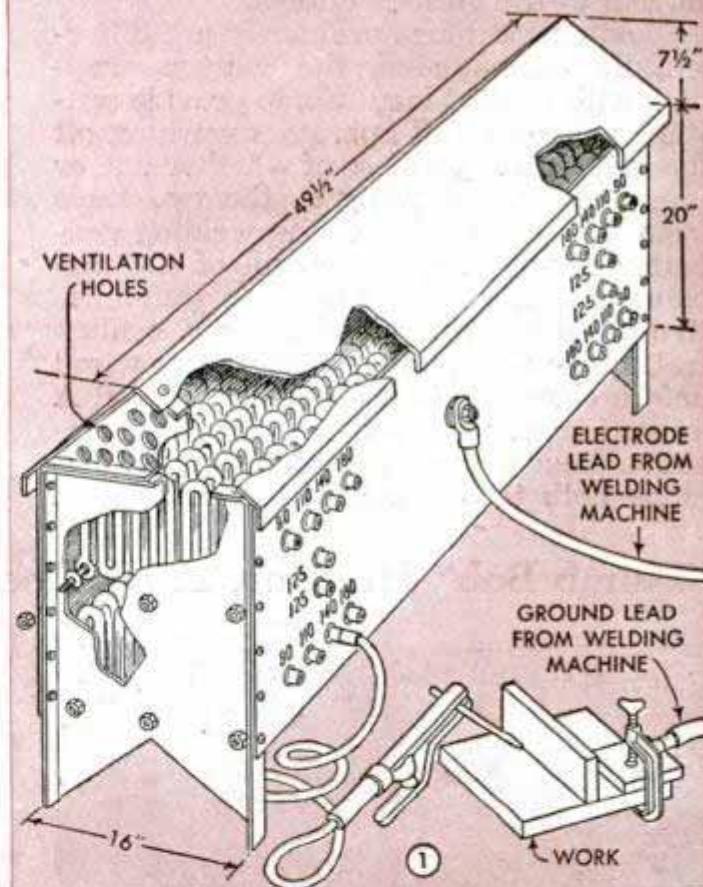
WELDING-MACHINE RESISTOR

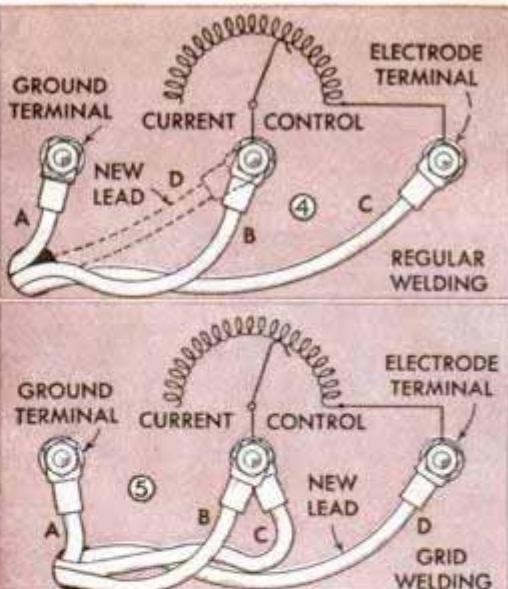
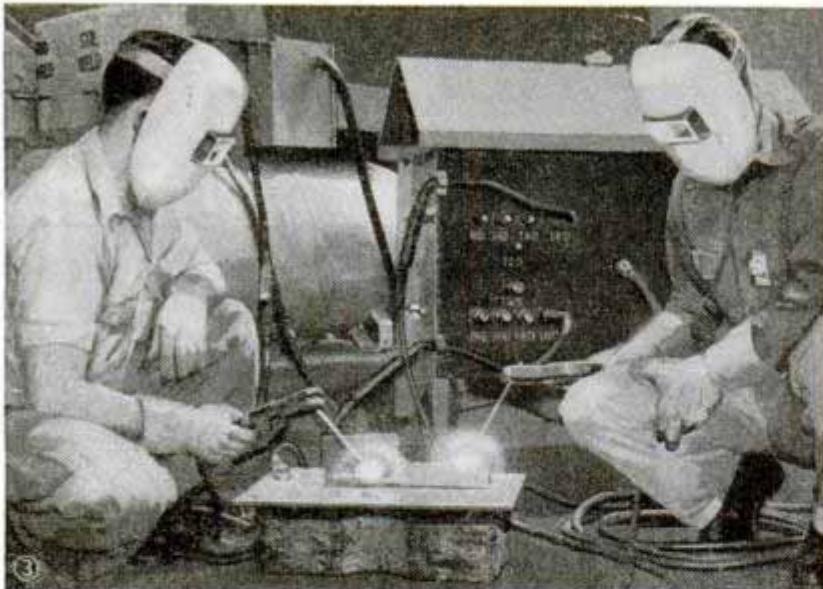
Has four electrode-holder outlets

By William R. Lewis

WELDING job shops, welding schools and other operators having occasional need for a number of machines in simultaneous operation have found that this four-lead grid unit pays for itself in a short time by making purchase of additional machines unnecessary. The unit was developed for use in conjunction with a 400-ampere welding machine and will permit up to four welders to work independently of one another within a range of 90 to 180 amperes.

Two rows of cast-iron resistance grids held together by long studs, which are insulated from the grids with mica tubing and washers, are mounted horizontally one above the other and enclosed in a heavy sheet-metal housing as shown in Fig. 1. Resistance in each row is arranged in steps of approximately $\frac{1}{4}$ to slightly over $\frac{1}{2}$ ohm to provide the various welding heats diagrammed in Fig. 2. Copper strips $\frac{1}{8}$ by 1 in. are used to connect the grids to the female part of electrode lead connectors mounted in the housing panel. Number 6 grids are used on the 90-ampere stage and number 3 grids for the other stages. These are heavy enough to stand the load without excessive heating. A center or common connector then is mounted





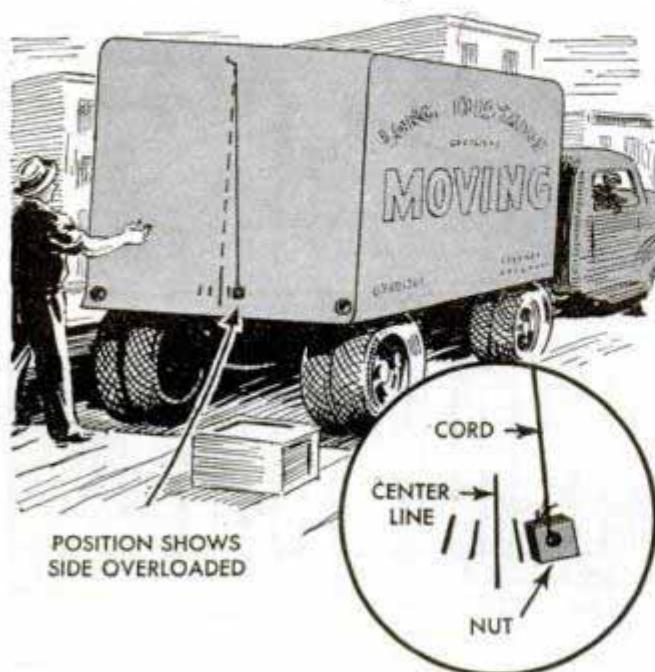
in the unit panel and hooked up with a copper strip to grids 14 and 15 in each row. In use, the ground lead is run directly from the welding machine to the work to be welded in the customary manner. The electrode lead from the machine is run to the center plug and the current then is carried to the various outlets.

Welding machines ordinarily are differentially compounded, the voltage dropping with applied load. So, to provide constant voltage to all operators working off the grid unit regardless of whether one or four welders are using it, the two leads from the series fields of the welding generator to the current control of the machine are reversed, resulting in accumulative or "over" compounding. Fig. 4 illustrates how the welding generator is wired before changing to grid welding. Lead A is connected to brushes within the machine. Lead B is connected within the machine both to one end of the series field

circuit and to one end of the interpole circuit. Lead C is connected to the other end of the series field circuit within the machine. To rewire for grid welding, lead B is disconnected from the series field within the machine but not from the interpoles. A new lead D is then connected to the end of the series field taken from B and brought through the case and connected to the same stud as B. With the new lead D in position as shown in Fig. 4 the machine still may be used for regular welding. To convert to grid welding merely interchange leads C and D as in Fig. 5. The current control then is adjusted to the point where voltage remains practically constant at all loads. It is not used thereafter for grid welding. Various heats for each of the four electrode holders are obtained by plugging in at the different taps in the panel.

A 100-ampere, double-pole, double-throw switch may be used to speed the change from regular to grid welding.

"Plumb Bob" Hung on Truck Door Will Indicate Uneven Loading

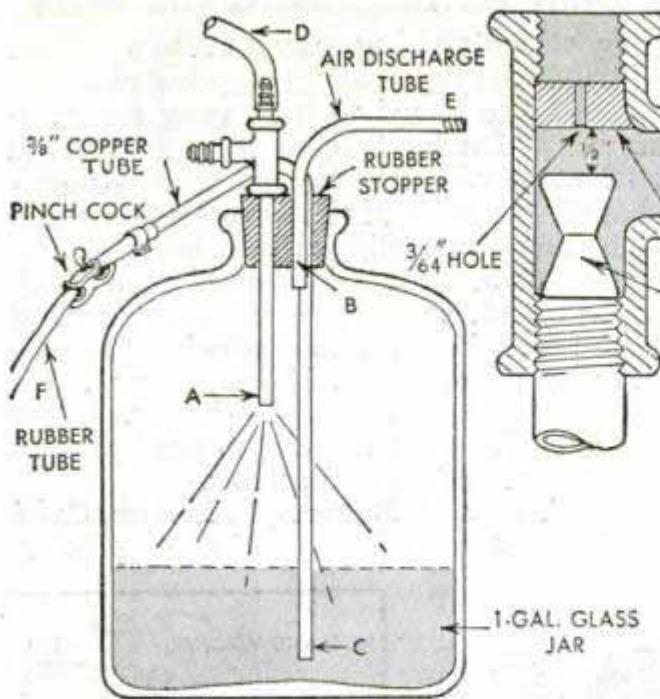


One fleet operator can tell at a glance whether any of his trucks are loaded more heavily on one side than on the other, a condition which may cause excessive wear on tires on the overloaded side. He screws a hook to the center of the rear door, and to it attaches a cord on which a nut or other weight is tied to act as a plumb bob. Then he marks the door at the center, as shown in the circular detail. When the truck is unevenly loaded, the weighted line shifts off center to indicate which side of the truck bears the excessive weight. The plumb bob should be removed before the truck goes on the highway.

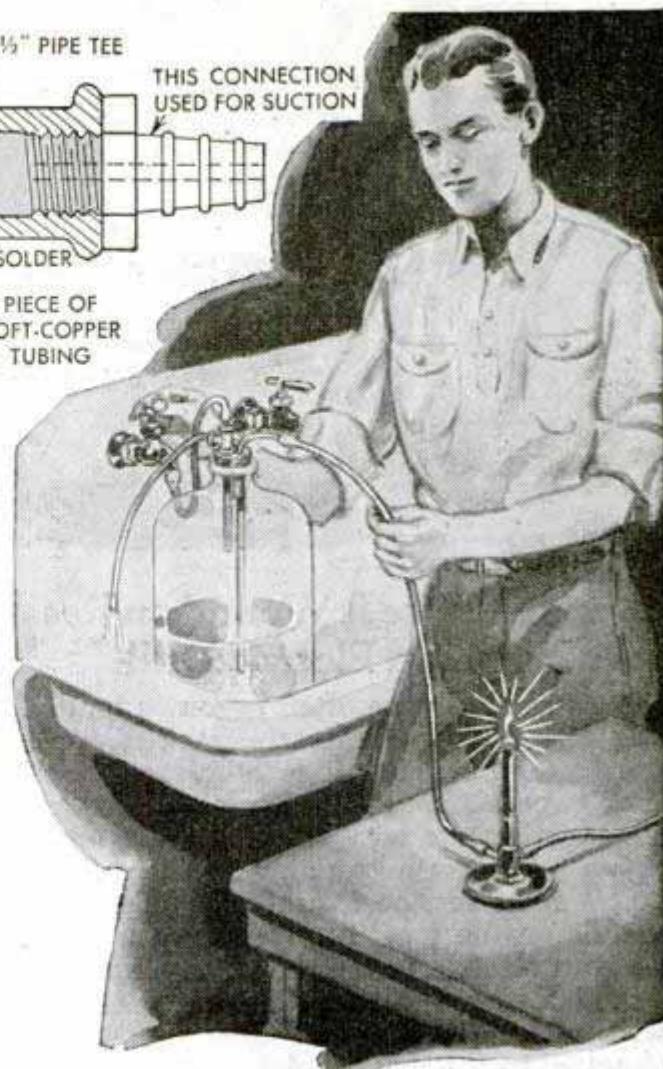
Opie Read, Jr., Chicago.

QThe corners of a notebook or writing pad can be rounded on a disk or belt sander so they will not tear pockets.

Air Compressor Operates Without Moving Parts



Laboratory workers, glass blowers and others who use Bunsen burners can easily make this air-compressor unit, which operates without any moving parts and delivers a steady supply of clean, washed air at a moderate pressure. The only part of the compressor to be made is the aspirator, which is fitted on a large glass jar or bottle, preferably one having a narrow mouth. The aspirator consists of a 1/2-in. pipe tee into which a nipple, A, and two hose connections are screwed. The connection in the center opening of the tee may be used for aspirating, or sucking, liquids, as well as for drawing air into the bottle. The tee is plugged with solder near one end just below the threads, after which a 3/16-in. hole is drilled in the center of the plug. A short piece of soft copper tubing just long enough to extend from the nipple to within 1/2 in. of the plug is flared at both ends to an hour-glass shape and soldered to the end of the nipple. This is inserted through a rubber stopper that has three holes in it. A rubber hose leading from a water faucet is fitted to the upper hose connection as at D. Then a length of copper tubing is inserted through the stopper to within a short distance of the bottom of the bottle as at C, and the projecting end is bent downward and fitted with a rubber tube, F, which is equipped with a pinchcock, petcock or needle valve for controlling the flow of water out of the bottle. An air-discharge tube then is put in the third hole of the stopper to project slightly below it as at B, and a hose, joined to the tube at E, is connected to the burner. In operation, when water is introduced into the bottle it sucks in air through the center connection of the tee.



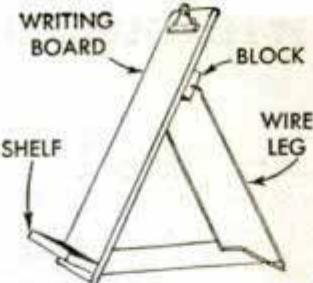
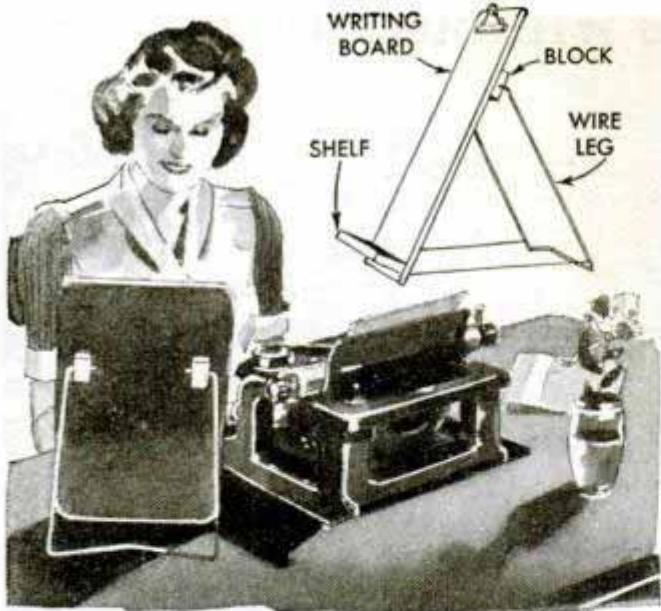
The water then is forced out from the bottom of the bottle through the valve and the rubber-tube outlet, and the air trapped above the water escapes through the discharge tube.—E. J. Hennessy, Chicago.

Lathe Compound Set at an Angle For Precision Turning

When working to close tolerances on a lathe on which both the cross-feed and compound-rest screws are graduated in thousandths, you can avoid some of the difficulty of setting the cutting tool to take a cut of less than .001 in. by lengthening its travel, thereby reducing its advance into the work. This is done by setting the compound rest at an angle to the lathe-center line. When the compound is set at an angle of 30 deg., advancing the screw .001 in. will move the tool less than this distance into the work. Similarly, the movement of the tool will be hardly noticeable if the compound is set at an angle of 6 deg.

E. E. Modes, Chicago.

To assure freedom from buckling, new floors in a house should be laid only when the temperature is right, 70 deg. in summer and 65 deg. in winter.



Typist's Copyholder Improvised From Writing Board and Wire

By attaching a leg or support to a writing board of the type having a spring clip, you can use the board to hold copy for transcribing. The leg is made from a length of stiff wire, which is formed to a wide U-shape. The ends of the wire are bent at a right angle and slipped into holes drilled in two blocks of wood bradded to the back of the board. Two pieces of string attached to the board with thumbtacks hold the leg at the required angle. If desired, a narrow shelf may be glued and bradded near the bottom edge of the board to hold pencils, erasers and other accessories.

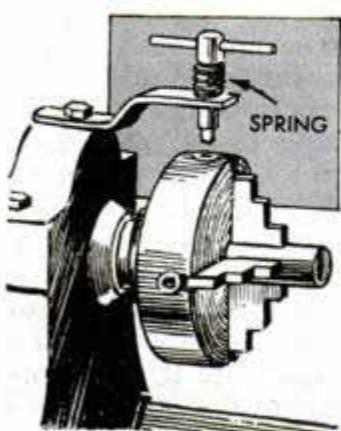
Edwin M. Roberts, Palo Alto, Calif.

Stranded Wire Is Wound on Reels With an Electric Drill

As stranded wire often becomes tangled and difficult to handle when taken out of the boxes in which it is delivered, much time can be saved in production shops by transferring the wire to reels, from which it can be unwound quickly for use. Small metal reels are best, as they are easy to handle on the job. To wind the wire on a reel, an electric drill is used. A stud is inserted through the reel core and secured with a washer and nut, then the stud is chucked in the drill, which is gripped in a vise. The wire is attached to the core and the drill is operated to wind the wire quickly.—F. C. Zuiker, Chicago.

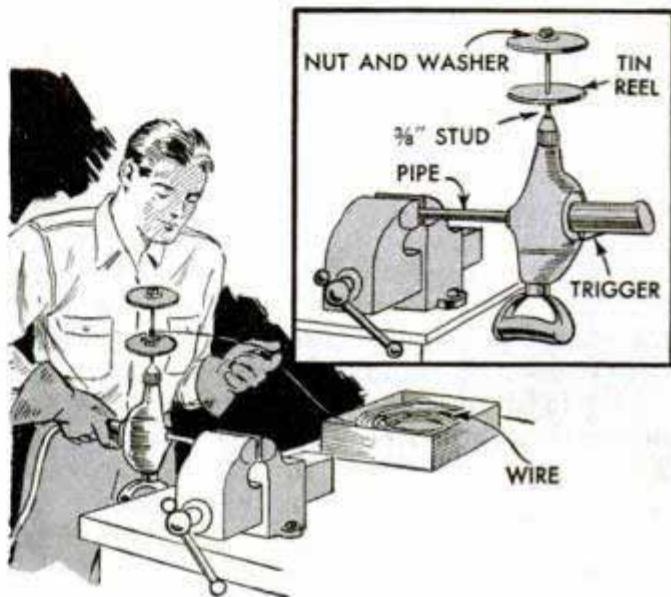
Holder Bolted to Lathe Housing Keeps Chuck Wrench Handy

Set in a holder bolted to the headstock bearing of a lathe, a chuck wrench will always be in position for immediate use. The holder is a length of flat iron bent as illustrated.



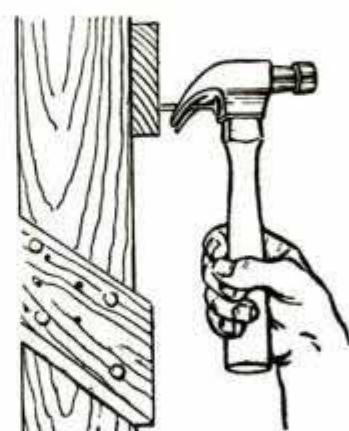
A hole is drilled in each end, one hole for a bolt by which the holder is attached, the other to hold the wrench directly over the chuck-jaw adjustment screws. A coil spring raises the wrench out of the way when not in use.

Since preserving the natural shade is the most satisfactory way to refinish antique wood, nondyeing oils are preferable to stains or varnishes for this purpose.



Nail Started in High Work By Using Hammer Claws

When nailing braces across the uprights of a high scaffold, one carpenter found that he could not reach high enough to hold a nail so that it could be struck, as no ladder

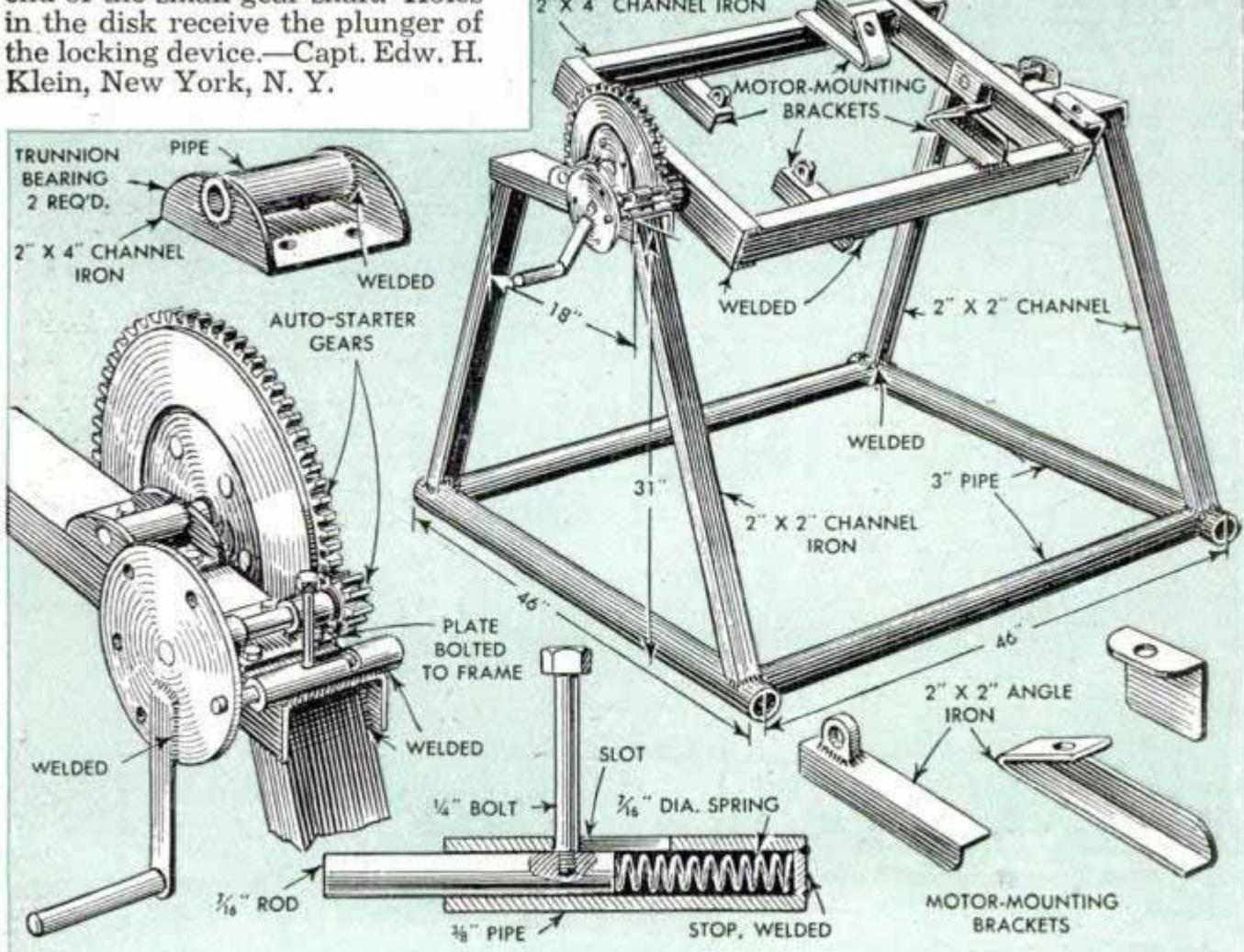
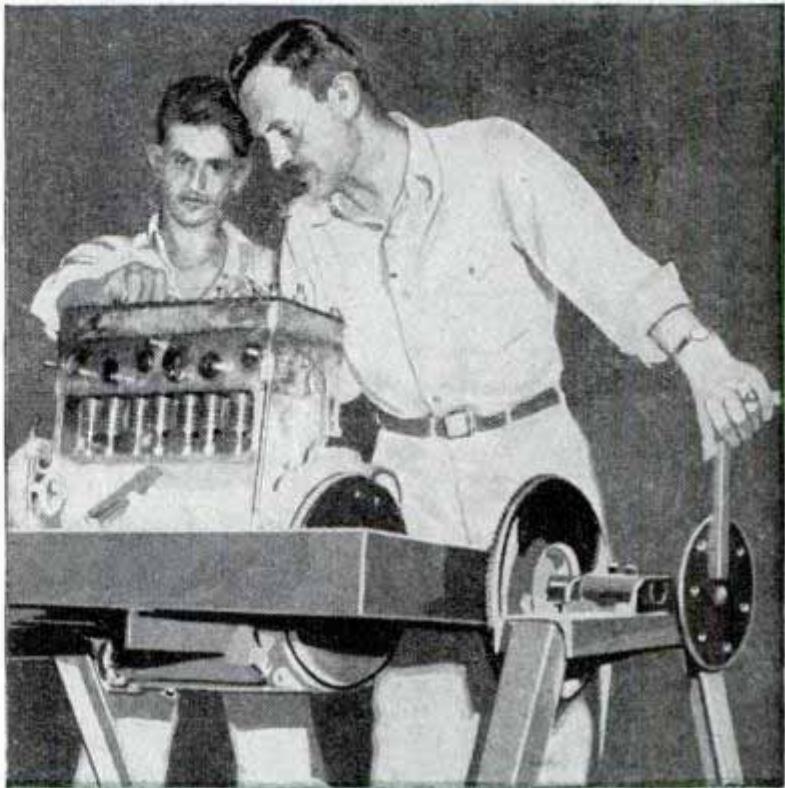


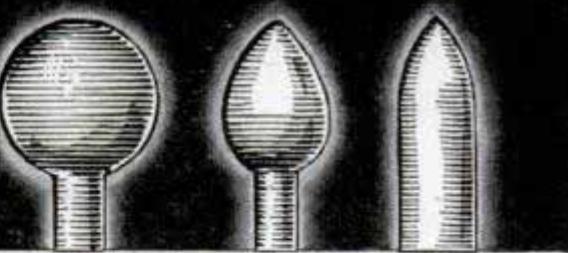
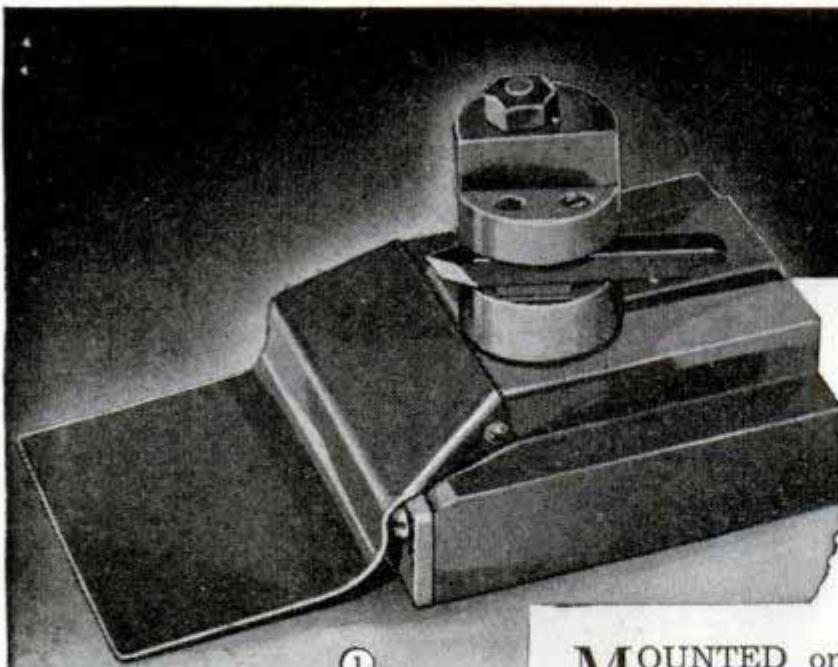
was available. To avoid having to go after one, the nail was placed point out between the claws of a hammer, as shown, and started in the wood. Then the hammer was disengaged and the nail was driven in.—Sgt. Malcolm Hunter, New York.

When tools are used outdoors they can be seen more easily, and are less apt to become lost or be left lying around, if they are painted a bright color, such as orange.

Adjustable ENGINE POSITIONER has many uses

CONSIDERABLE time can be saved when repairing or rebuilding automobile motors by using this adjustable engine cradle. Although ideally suited for garages specializing in one particular type of car, the cradle can be provided with different motor-mounting brackets as needed. The details below clearly illustrate its construction. The tilting mechanism is made from auto-starter gears, the pinion shaft rotating in two short lengths of pipe welded to a plate, which is bolted to the frame to obtain proper clearance between the gears. The auto-engine flywheel with its ring gear is welded to the tilting frame that turns in two bearings made as shown. To hold the engine at the desired angle a metal disk and crank handle are welded to the end of the small gear shaft. Holes in the disk receive the plunger of the locking device.—Capt. Edw. H. Klein, New York, N. Y.



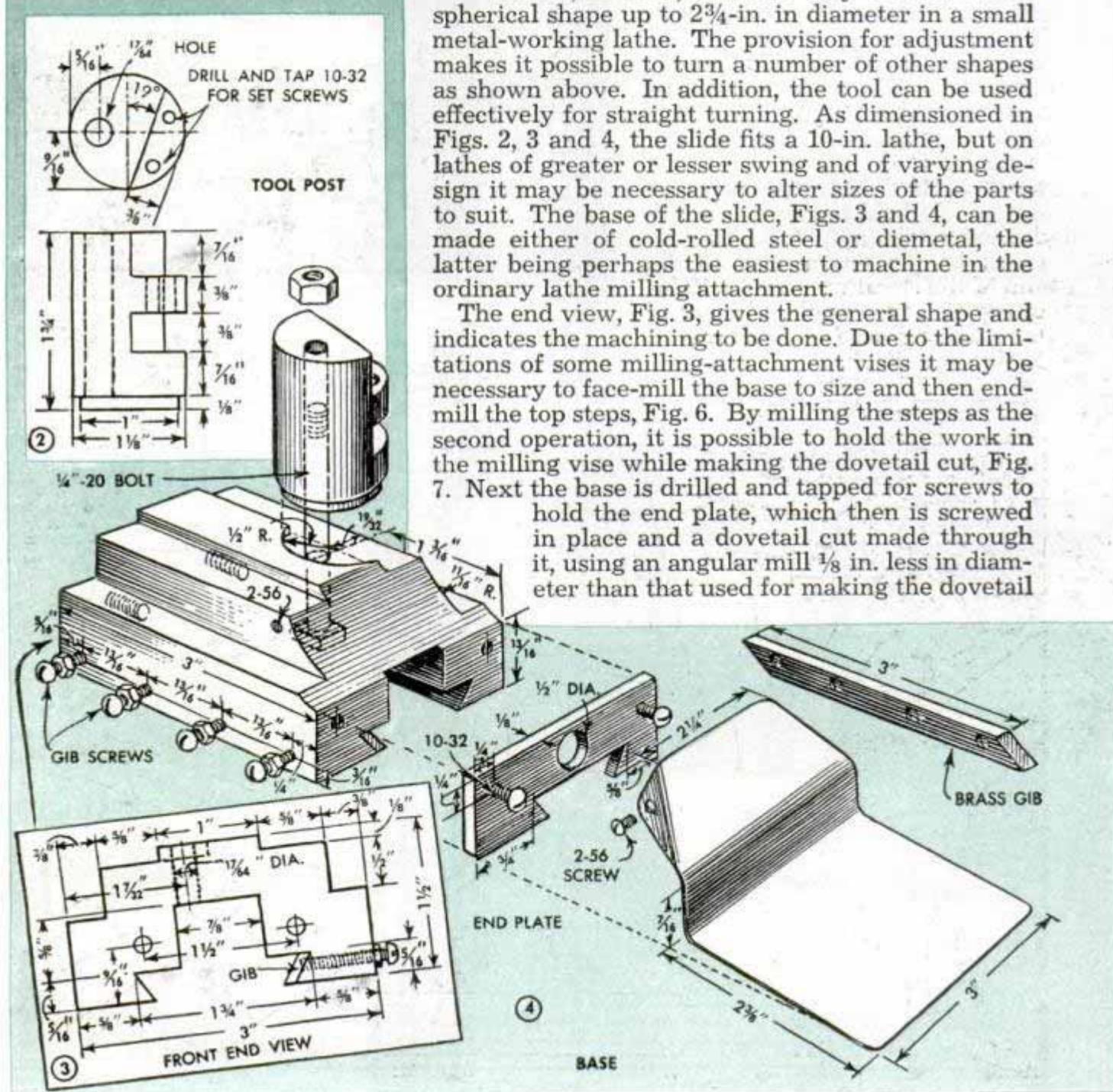


Tool Holder
CONVEX

By W. T. Warde

MOUNTED on the lathe compound, this tool holder, or slide, makes it easy to turn a true spherical shape up to 2 $\frac{3}{4}$ -in. in diameter in a small metal-working lathe. The provision for adjustment makes it possible to turn a number of other shapes as shown above. In addition, the tool can be used effectively for straight turning. As dimensioned in Figs. 2, 3 and 4, the slide fits a 10-in. lathe, but on lathes of greater or lesser swing and of varying design it may be necessary to alter sizes of the parts to suit. The base of the slide, Figs. 3 and 4, can be made either of cold-rolled steel or diemetal, the latter being perhaps the easiest to machine in the ordinary lathe milling attachment.

The end view, Fig. 3, gives the general shape and indicates the machining to be done. Due to the limitations of some milling-attachment vises it may be necessary to face-mill the base to size and then end-mill the top steps, Fig. 6. By milling the steps as the second operation, it is possible to hold the work in the milling vise while making the dovetail cut, Fig. 7. Next the base is drilled and tapped for screws to hold the end plate, which then is screwed in place and a dovetail cut made through it, using an angular mill $\frac{1}{8}$ in. less in diameter than that used for making the dovetail

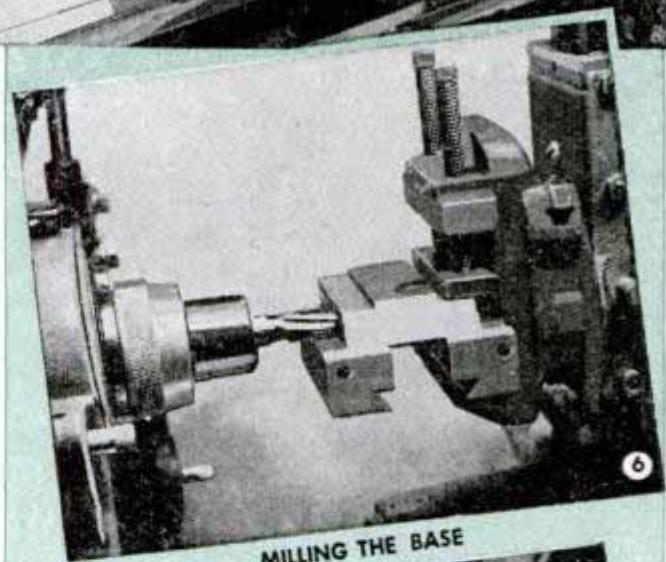
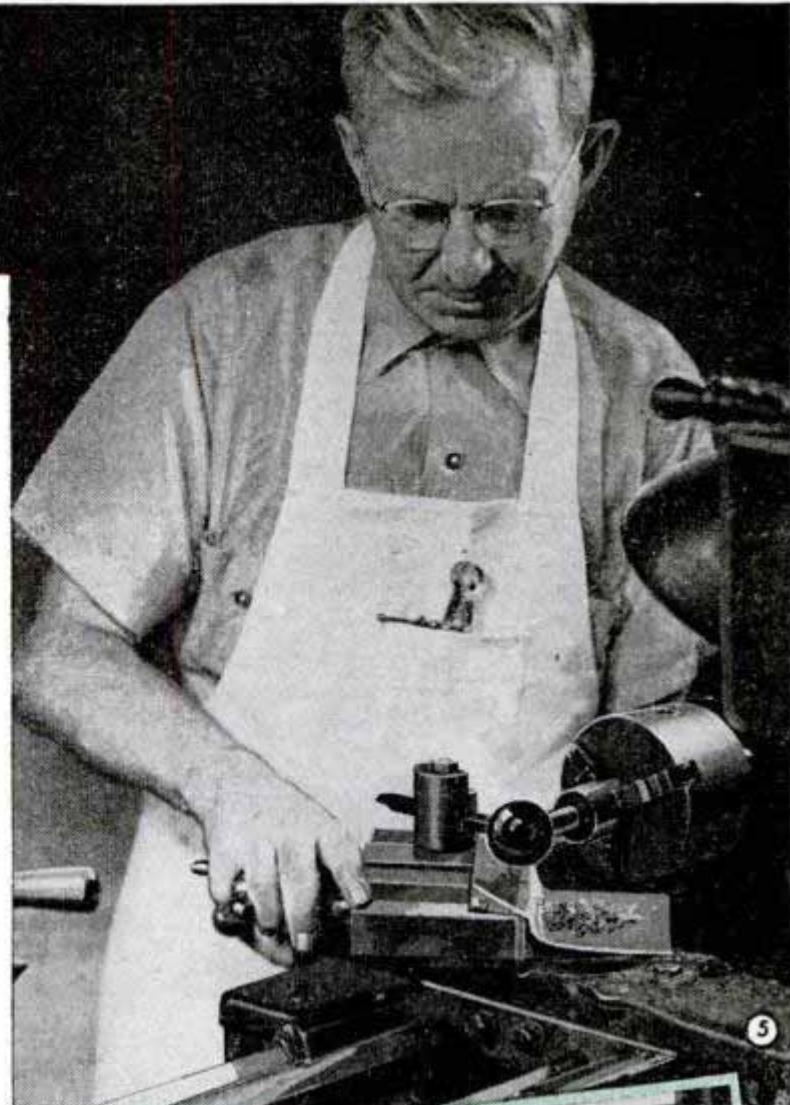
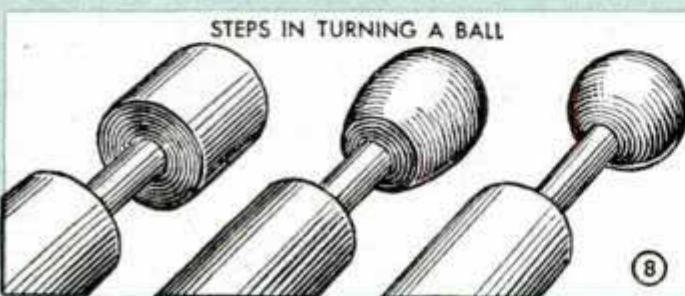




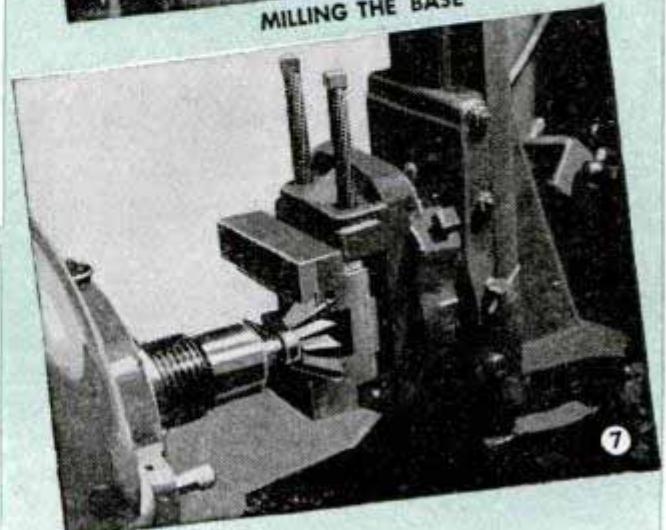
Simplifies TURNING

cut in the base. In this way, the end plate acts as a stop for the gib. Then the end plate is removed and the $\frac{7}{8}$ -in. groove for the feed screw is cut. The curved bevel cut across the upper half of the front can be made with a half-round file to a radius sufficiently accurate for practical purposes. The circular cut in the top of the base for the tool post is made on a drill press, using a 1-in. diameter Woodruff cutter. One side of the base is drilled and tapped for four gib screws carrying lock nuts as indicated. The gib is cut from $\frac{1}{8}$ -in. brass or mild steel and dressed to a sliding fit on the compound slide with the screws loosened. The tool post, Fig. 2, is a simple milling job on $1\frac{1}{8}$ -in. round stock and the feed-screw guard, Figs. 1 and 4, can be made from light sheet metal and attached with a machine screw as indicated.

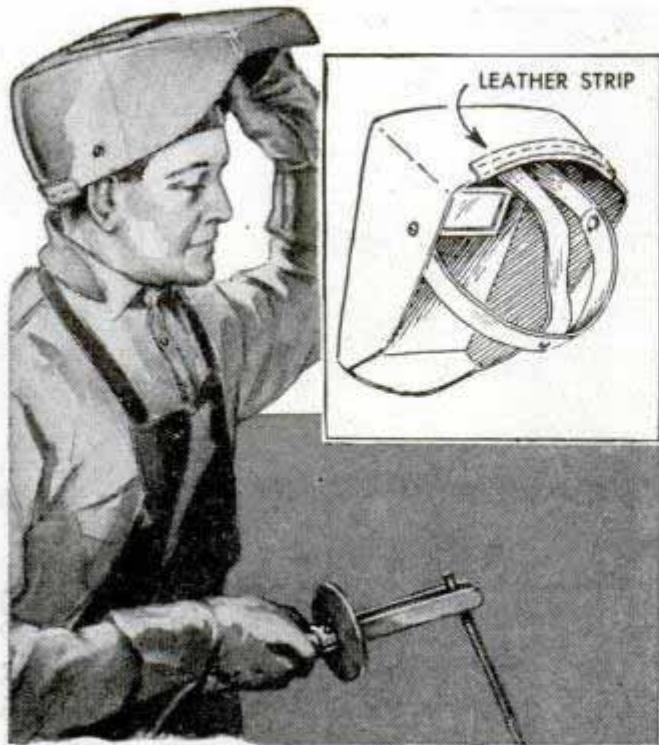
To assemble and mount the finished job, Fig. 5, the compound rest is removed from the lathe, leaving the feed screw in place. The base is slid onto the ways and the feed-screw assembly attached. Next the cutter bit is shimmed up to exact center and the compound is loosened until it swings with a slight drag. Then, with a piece of metal in the chuck, the lathe is started and by simultaneous movement of the cross feed and the compound the point of exact center of the tool is located and a light line is scratched on the cross-slide way to indicate this position so that the slide may always be returned to the same location.



MILLING THE BASE



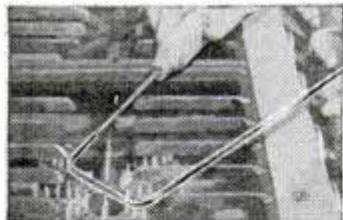
Leather Strip on Edge of Helmet Protects Welder's Neck



One welder found that a strip of leather, when sewed to the top edge of his helmet, will prevent it from digging into his neck when the helmet is raised. The leather is cut from the uppers of a pair of shoes and then sewed after holes have been punched in the helmet. As an alternative, split rivets can be used to fasten the strip.

John Krill, Youngstown, Ohio.

Ice Pick Is Used to Bend Tubing



If glass tubing is to be bent on a short radius, an ice pick inserted in the tube can be used as a lever to make the bend. When pliers are

used they may break the tube, and bending by hand often results in burning one's fingers.

Counter Made From Compass Is an Aid to Printers



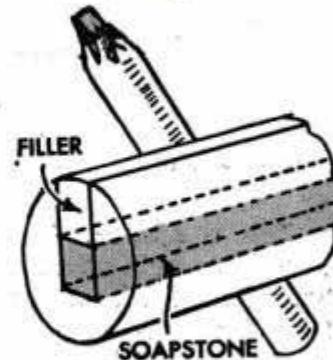
Printers and stationers who need a pad counter in their work can make one from an adjustable compass and divider of the kind having hollow legs. After removing the divider point and

pencil, both legs should be flattened at the ends and filed to an oval shape. When doing this, make one of the legs shorter than the other. By using the adjusting nut, any size pad desired can be made.

Albert Stewart, Kansas City, Mo.

Wood Sheath for Soapstone

Soapstone sticks, such as used for marking steel and similar surfaces, are brittle and break easily. To prevent this, I encase the $\frac{1}{4}$ by $\frac{1}{4}$ by 6-in. stick in a $\frac{3}{4}$ by $\frac{3}{4}$ by 6-in. piece of white pine to make a pencil. This is done by cutting a $\frac{1}{4}$ by $\frac{1}{2}$ -in. groove in the wood, gluing the soapstone in the groove and filling with a $\frac{1}{4}$ -in. square of pine. When the glue is dry, the pencil can be rounded and sharpened for use.—Conrad F. Sohn, Jr., Towson, Md.



Panel Across Top of Garage Door Prevents Escape of Heat

A plywood panel hung across the doors of a garage will help conserve heat by preventing escape of warm air, which, of course, is always near the ceiling. In garages where trucks are not serviced, the panel can be screwed to the door frame, allowing only room enough for cars to pass through. The panel can be made removable by drilling it for pins on which it is suspended.—Hal Geihm, Aurora, Ill.



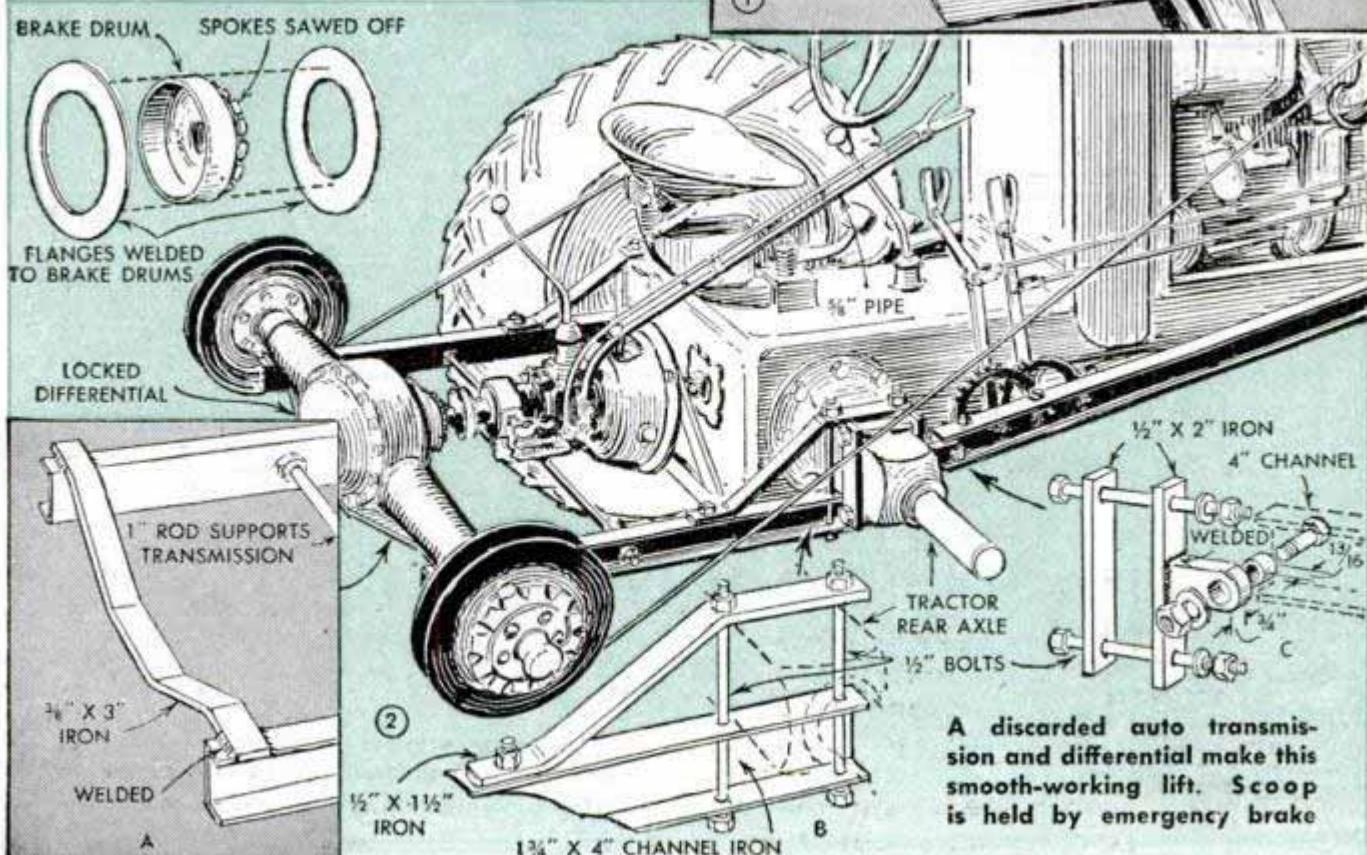
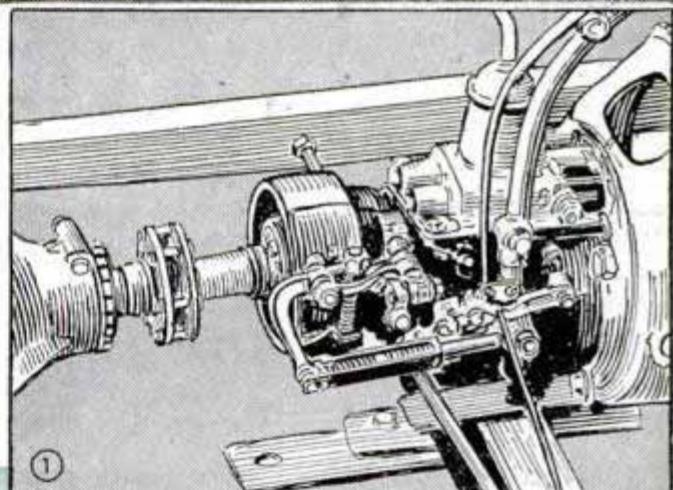
TRACTOR SCOOPTS

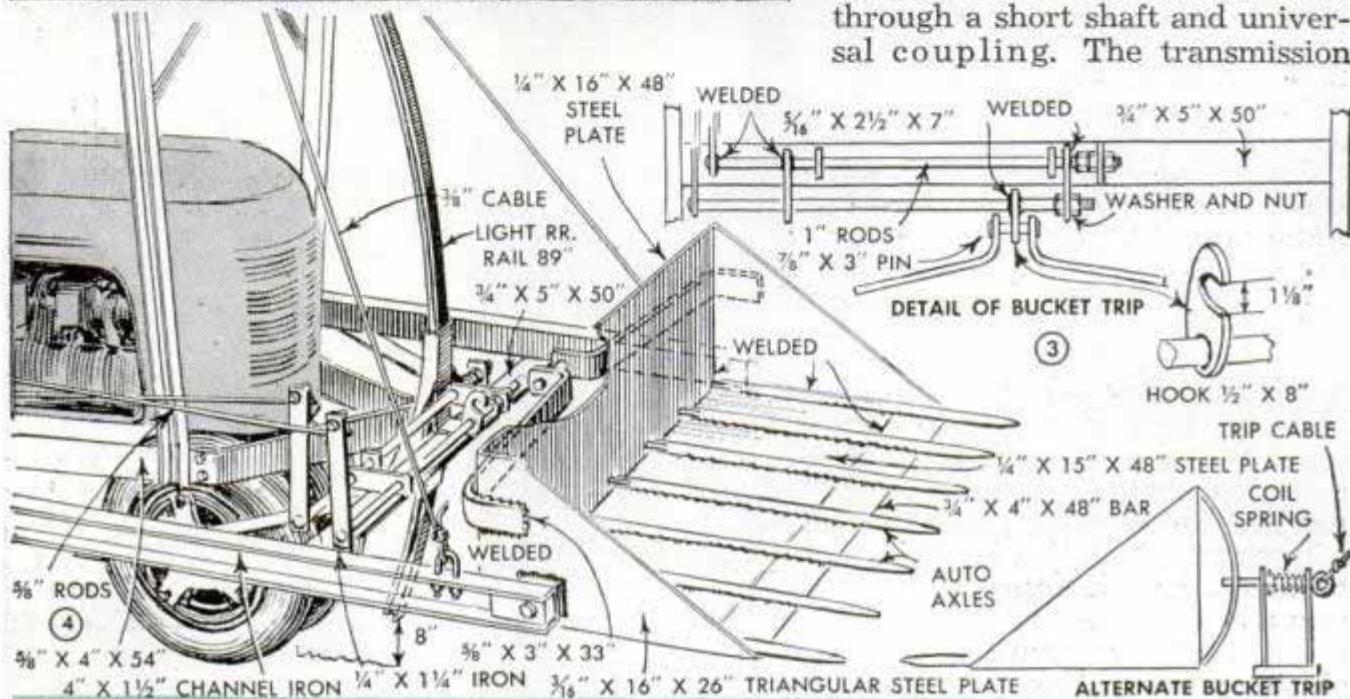
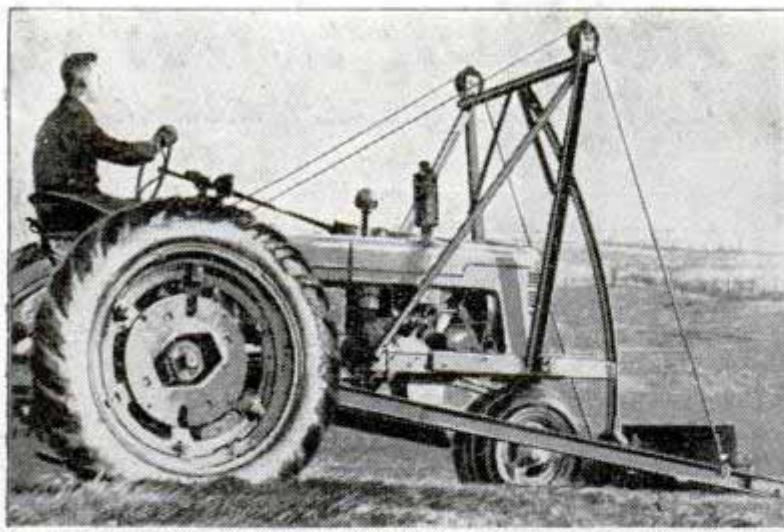
built from scrap materials



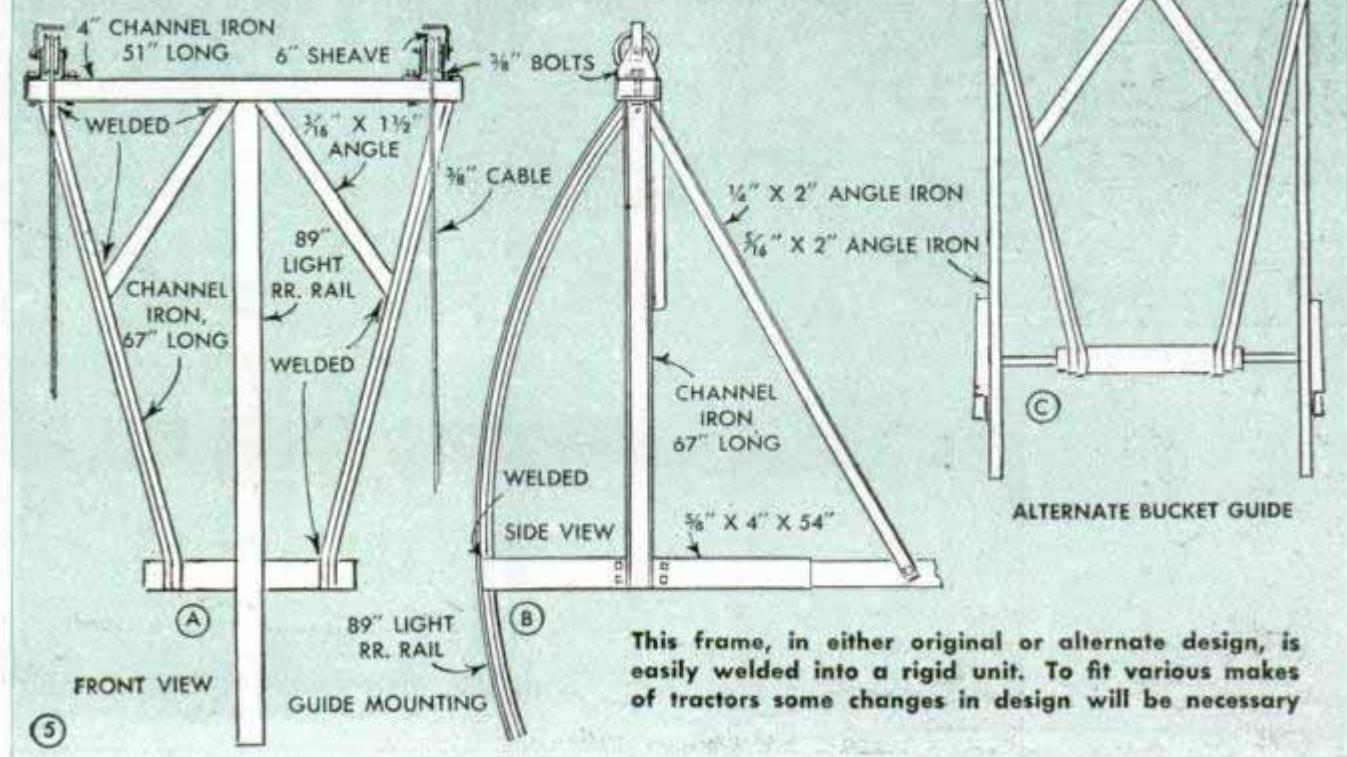
Photos and certain detail drawings
courtesy State College of Washington

WITH a few salvaged auto parts, several lengths of 3 and 4-in. channel irons, angles and other odds and ends you can build an efficient tractor scoop that will increase the working capacity of one man a hundredfold. In Fig. 1 is pictured a lifting mechanism made from an auto transmission and rear axle, while Fig. 2 details the lifting assembly mounted on the rear axle of the tractor. The auto differential is locked with a weld, or by other means, and





The curved guide made from a small industrial-type railroad rail keeps scoop from swinging sidewise. Radius of the curved portion of the rail can be determined after lift is in position



This frame, in either original or alternate design, is easily welded into a rigid unit. To fit various makes of tractors some changes in design will be necessary

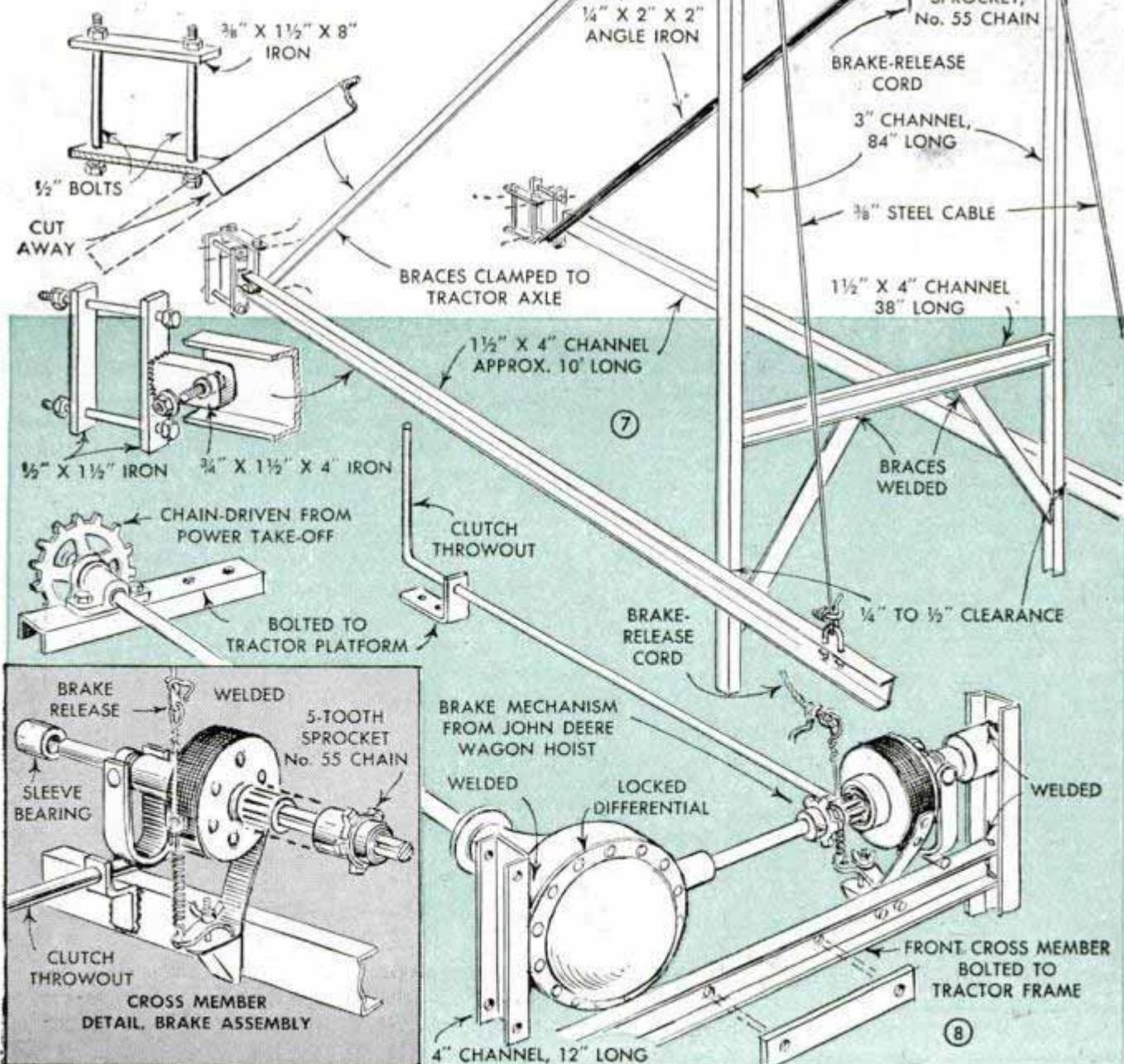
mounted on a frame, details A and B of Fig. 2; then bolted to the tractor-axle housing as in details B and C of Fig. 2. After the wheels have been removed from the auto axle, weld flanges on the brake drums to serve as winding drums for the lifting cables. Then the axle is bolted to the extending channels through the spring pads, or welded if the pads won't serve this purpose.

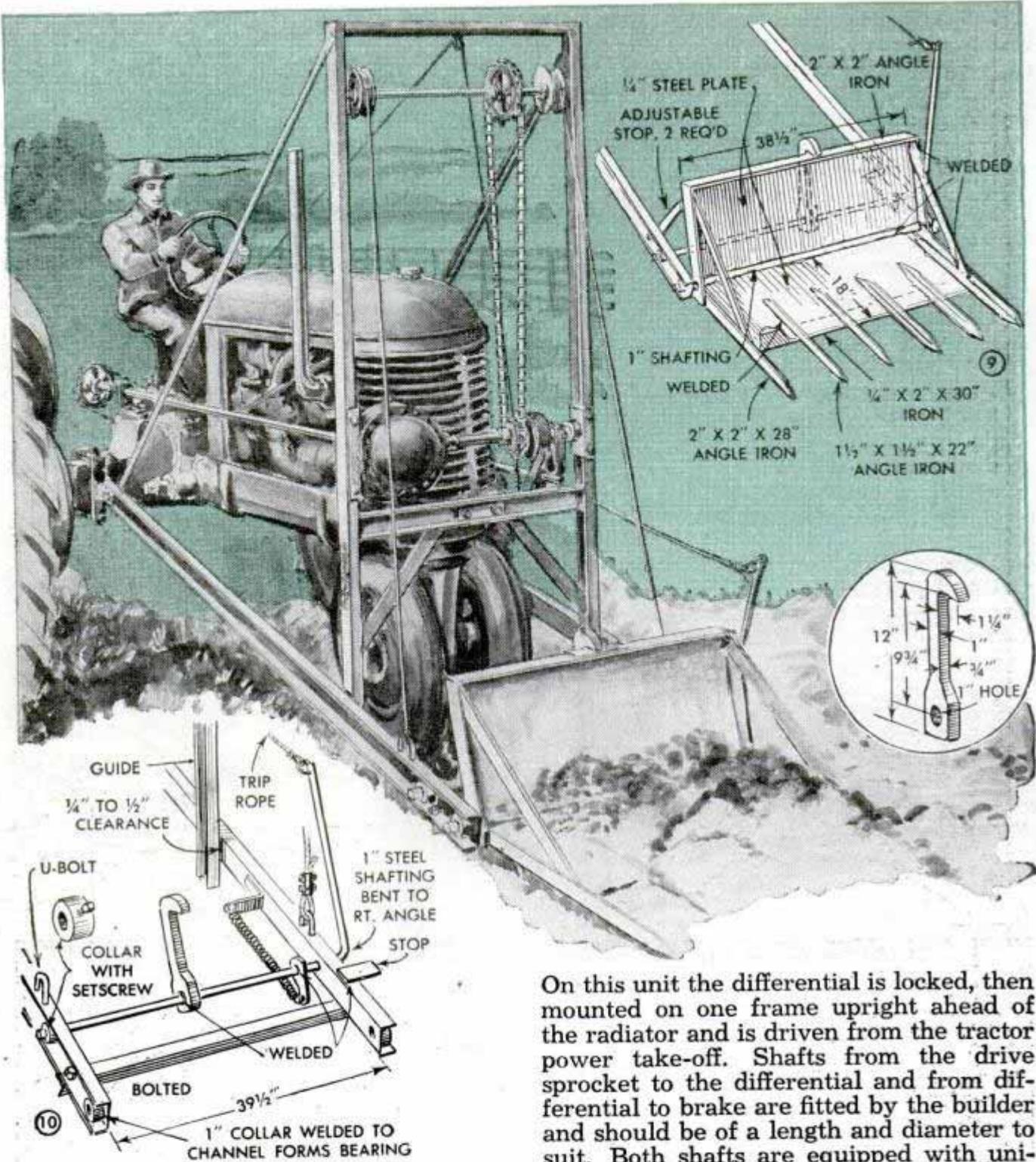
After the transmission has been mounted on the frame as shown, it is connected to the tractor power take-off and to the auto rear axle through a short shaft and universal coupling. The transmission

must be of the type having an emergency brake at the rear of the housing. To make the brake lever easily accessible, lengths of pipe are welded to the lever and control rod and then bent forward toward the driver's seat. Applying the brake holds the scoop in the raised position.

Further details of the scoop, latch and lifting frame assembly that is mounted on the front of the tractor are found in Figs. 3, 4 and 5. The curved guide, Figs. 4 and 5, A and B, can be made from the industrial-type railroad rail specified or from a length of T-shaped steel wide enough across the flat side for a short "shoe" of 3 or 4-in. channel steel to ride on it smoothly. After the front frame is in place with the scoop arms attached, the radius of the guide can be determined.

Two methods of tripping the scoop are provided. One is detailed in Fig. 3, and a simple alternate arrangement, where dumping is accomplished by pulling a cord, is shown in Fig. 4. In the first arrangement, one of the pair of levers shown in Fig. 2 releases the trip





and the other levels the scoop. An alternate type of lifting frame is shown in detail C of Fig. 5 where side uprights, instead of the curved rail, serve as guides for the arms that lift the scoop. In Fig. 6 the finished assembly is pictured ready for work.

Differing from the scoop just described, Figs. 7 and 8 present a type that has a lift employing an auto differential with the axle shafts removed and the housings cut away. Here the bucket is held in the raised position and released for lowering by means of a wagon-hoist brake driven by a jaw clutch, as in Fig. 8 and the detail at the left. The clutch and brake are stock parts and are purchased as a unit. However, the U-shaped throwout and the long shaft and throwout lever are made to fit, see Fig. 8.

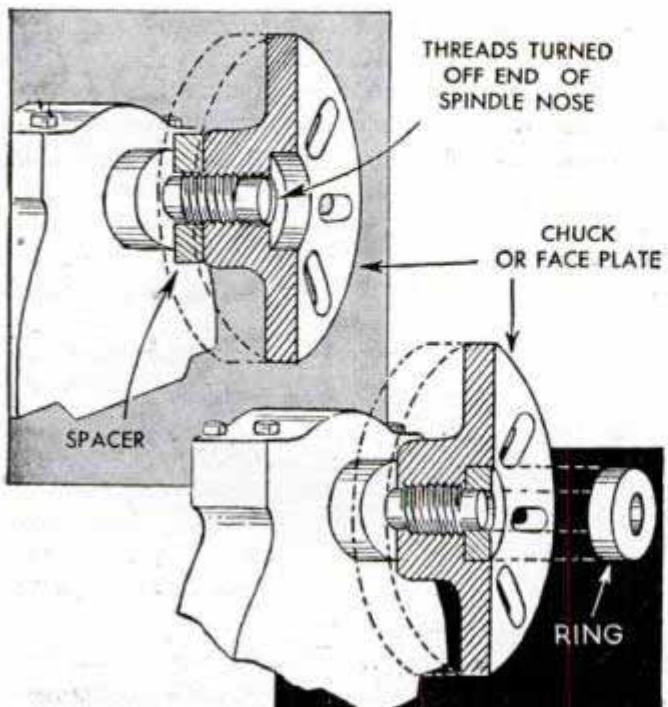
On this unit the differential is locked, then mounted on one frame upright ahead of the radiator and is driven from the tractor power take-off. Shafts from the drive sprocket to the differential and from differential to brake are fitted by the builder and should be of a length and diameter to suit. Both shafts are equipped with universals at one end to compensate for any misalignment of the frame which would cause the shafts to bind. Shafting $\frac{7}{8}$ or $1\frac{1}{4}$ in. in diameter is amply heavy for this drive, and stock sprockets and other slip-on parts usually fit one or the other of these dimensions. On this type scoop, there are two winding drums and a 10-tooth sprocket on the upper shaft, which rotates in bearings made from blocks of hardwood provided with some means of lubrication. Figs. 9 and 10 show the scoop construction and the bucket release assembly. Of course, scoops can be made in many forms to suit special purposes and by either of the methods shown in Figs. 4 and 9.

Tractors of different makes vary in width of frame, type of frame, wheelbase, height

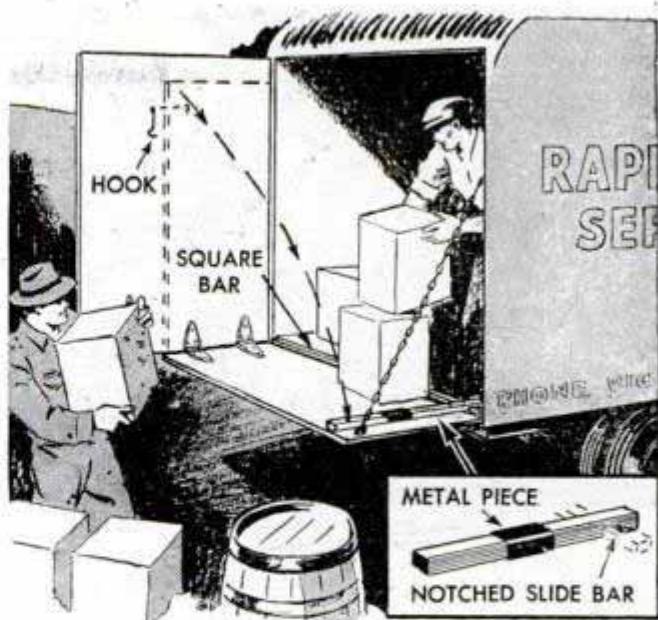
and wheel diameters. Because of these variations, only a few general dimensions can be given on the frame parts of the scoops. Nearly all parts of either one must be made to suit the tractor on which the unit is mounted. As a general practice, it is usually better to mount the front frame first, before cutting any other materials. With this part of the lift in position, it's an easy matter to determine the dimensions of other parts by direct measurement. In some instances, due to the design of the tractor frame, it will be necessary to fit braces and supports in a manner different from that indicated in the details. Also, it is possible to substitute hardwood for many of the frame parts. As an example, the lifting arms and the frame uprights can be of 4 by 4-in. oak or maple. However, a frame built of welded steel channels and angles gives longer and more satisfactory service due to its greater strength, rigidity and ease of assembly.

Chucks and Face Plates Repaired With Ring Inserts

After extended use, spindle threads on lathes become worn and are not sufficiently rigid for heavy chuck and face-plate work. Rather than rethread the spindle, a simple remedy is to turn the threads off the nose for a short distance and provide the chuck or face plate with a ring insert that will slip over the turned portion without side play. To bore for the ring insert, place a spacer thicker than the turned portion of the spindle back of the chuck and cut the latter for the insert. After pressing the ring in place, it can be bored for a perfect fit on the spindle nose.—Pvt. Laurence H. Seibert, Camp Crowder, Mo.



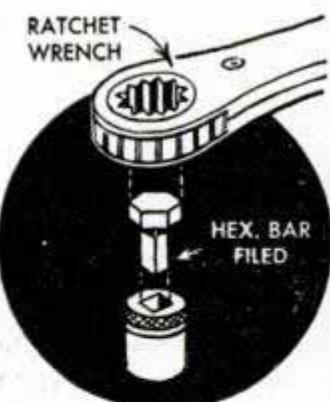
Drop-Leaf Tailboard on a Truck Facilitates Sorting Loads



To provide a small loading or sorting platform at the rear of trucks and vans that have one rear door, a tailboard can be hinged to the inside of the door at the lower edge. In use, the tailboard is supported by a length of chain attached to the inside of the truck body, and by a sliding bar that is notched at one end to engage a cleat, or square bar, on the truck floor. The bar slides in a metal sleeve screwed to the tailboard. When not in use, the tailboard is raised and hooked to the door.

Adapter Extends Use of Wrench

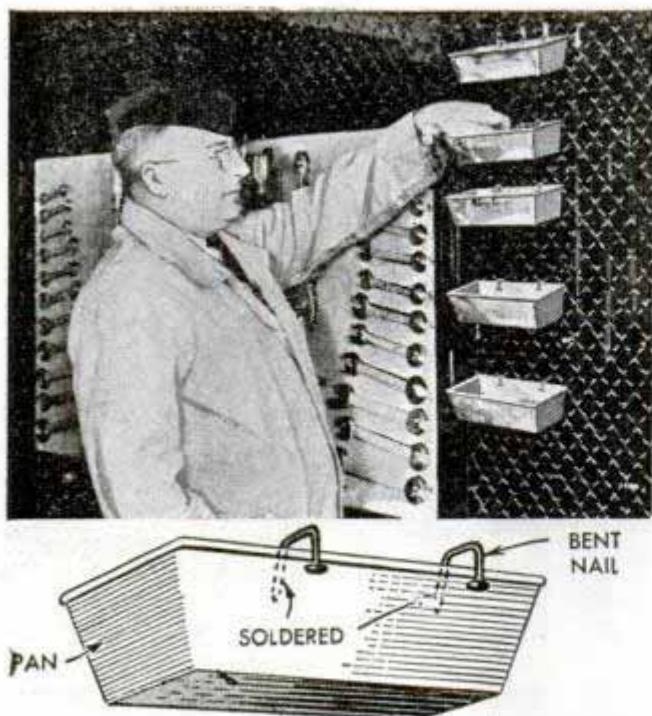
The function of a ratchet wrench can be extended to include using it as a socket-head wrench with this attachment. It is made from a hexagon-shaped bar of a size to fit the wrench, with the part fitting into the socket filed down to the proper dimensions. Sets can be built for many sizes of socket-head screws and fittings.—Bruce Watkins, Osceola, Ind.



By using a knife with a magnetized blade, modelmakers will save much of the time spent in picking up steel pins used to hold glued parts for drying. The blade can be magnetized by stroking it over a magnet or by holding it in the center of a coil connected to two dry cells wired in series.

Harold Weesner, Newburg, Ore.

Pans Converted Into Stock Bins Provide Additional Space

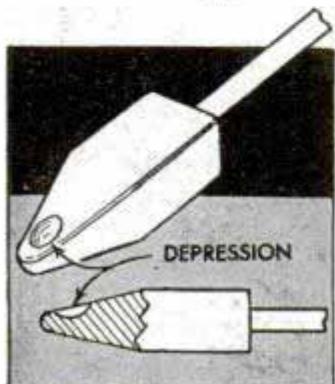


A stock-room man in one shop found that bin space could be increased by hanging bread pans on the wire cage walls of the room, as shown. Hooks for hanging the pans were made by bending nails and soldering them to the inside surface of the pans. Spacing of the hooks should be such that each will rest on the bottom of a "V" in the wire netting.—C. E. Packer, Chicago.

Solution Shows Flaws in Metal

Invisible cracks in metal parts can be detected by the following method: Clean the part thoroughly with kerosene or gasoline, after which it is wiped dry and warmed slightly to assure complete dryness. Then dip it into a solution of kerosene and a small amount of oil. Dry the part and spray it with any quick-drying mixture that will leave a white coating, such as a thin emulsion of zinc oxide powder in pure wood alcohol. After the part has dried for a few minutes, flaws will show up as brown lines on the white surface.

How to Improve a Soldering Iron



The seemingly difficult task of soldering from the underside of the work, and keeping the solder on the upper side of the iron, is a trick known to many tinsmiths. For this work, it is better to shape the iron

like a chisel, drawn narrower at the point than at the shoulder of the bit. Then, on the upper surface near the tip, cut a small depression just large enough to hold a drop of solder. Tin only the upper side of the iron, being sure that the other three sides do not retain solder.

John C. Sommer, Saginaw, Mich.

Drill Rod Kept From Oxidizing When Heated for Hardening

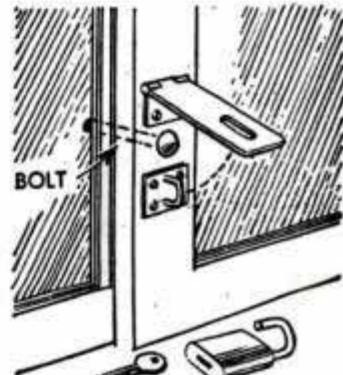
When you have occasion to harden a short length of drill rod, place it in a small metal container and cover it with brazing flux. When this melts, it seals the rod from air to prevent oxidation in the heat. When the work is quenched after heating, the flux will crack off, leaving the rod as clean as it was before hardening.

E. J. Murawski, Baltimore, Md.

Showcase Lock Protects Wares

A simple showcase lock can be made by using a hasp, a carriage bolt and a padlock. Where the sliding sections of the case overlap, drill a hole large enough for the bolt and fasten the hasp over the bolt so it will cover all exposed screws when closed. The padlock is fastened through the staple.

Helen M. Douglas, Commerce, Tex.

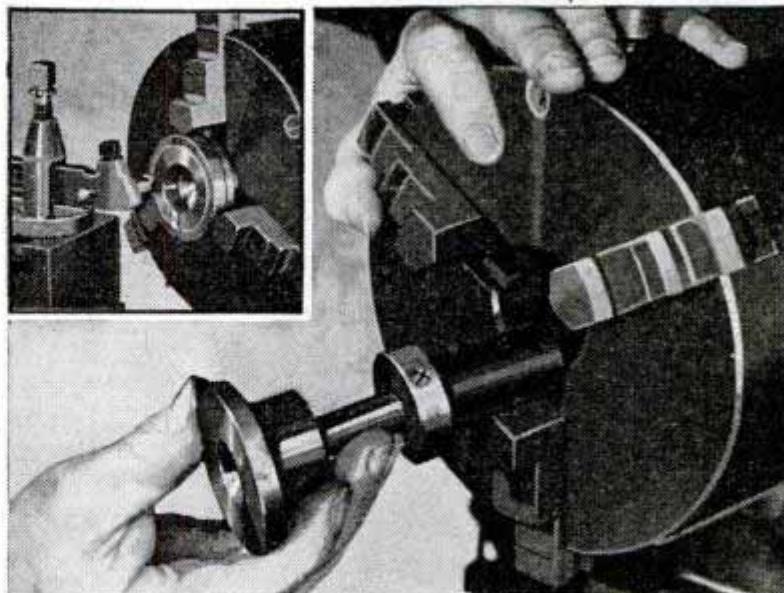
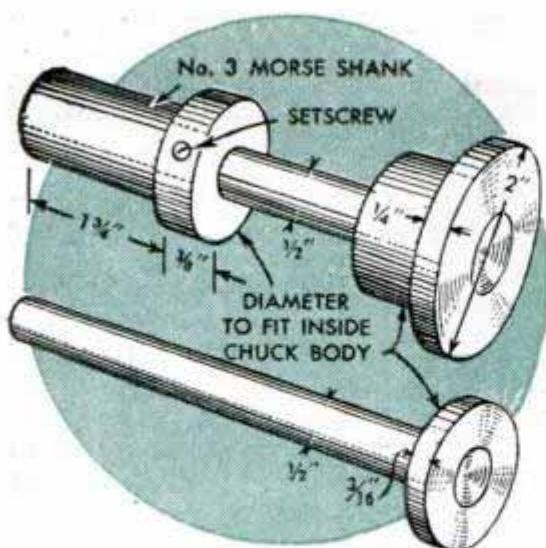


Stock Cars Used for Corn Crib And Overhead Granary

One farmer solved a building problem by using two railroad stock cars in the construction of a double corn crib and overhead granary. The cars were set on a concrete base for use as corn cribs and the space under the roof served as a granary.



Chuck Backstop Supports Thin Metal Disks



This backstop unit disposes of the problem of mounting thin metal disks in a three-jaw chuck. It's adjustable in or out to suit varying thicknesses and can be locked in any position for facing and boring operations on duplicate parts. The Morse-taper shank, cut from a broken carbon-steel drill, is fitted with a turned collar and setscrew, and is center-drilled to take the spindle of the stop or "pad." The shouldered portion of the stop is turned down to the same diameter as the collar on the tapered sleeve

so that it slips inside the chuck body. The stop spindle should be finish-ground to a close sliding fit and the stop face must be trued with the unit mounted in the taper shank. For handling work of smaller diameters a second stop can be made as in the lower left-hand detail, the head of the stop being turned down to a diameter that will allow it to slide inside the chuck body. This makes the stop unit more nearly universal. Before mounting work be sure that the surfaces are clean and free from chips.

Kettle Set in Oil Drum Is Used as an Outdoor Feed Cooker

By setting an iron cooking kettle into an oil drum from which the top has been removed, and fitting the drum with a door and stovepipe, you can improvise a sturdy outdoor cooker for use when preparing feed. A stove or furnace door is riveted over an opening cut in one side of the drum, and a length of stovepipe is fitted over a hole cut in the opposite side. A fuel tank mounted on an adjoining support such as a fence post holds waste crankcase oil. This is piped into the drum, a valve being installed to control the flow of oil. Bricks can be laid in the drum to catch the oil and serve as a grate, or cement can be laid to build up a firepot if no brick is available.

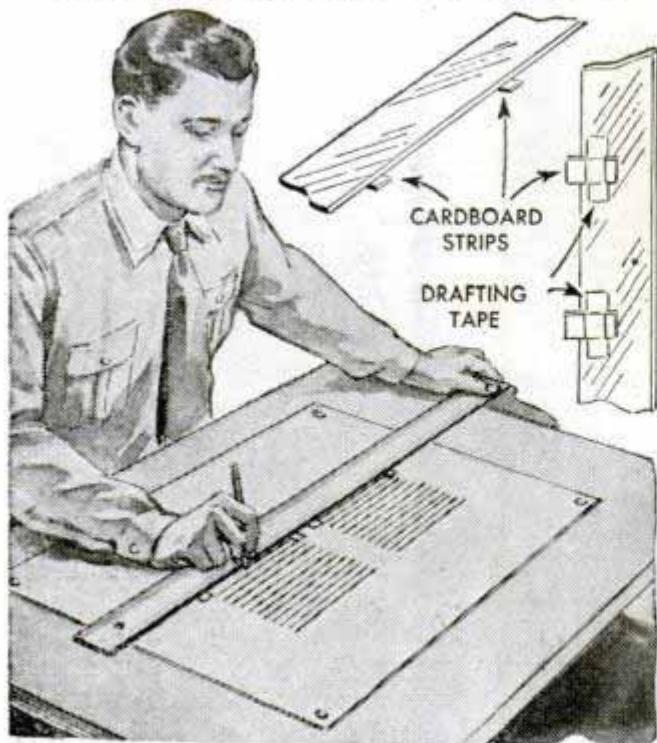


Typing on Adhesive Tape

To type on adhesive tape that is to be used for labels, place it lightly and smoothly on a sheet of photographic film. This will roll easily into the typewriter carriage and support the tape. When the typing has been completed, the tape can be stripped off the film. To keep the surface of the labels clean after they have been typed, coat them with colorless nail polish.

H. L. Thompson, Sarnia, Ont., Can.

Guide Tabs Minimize Eyestrain When Drawing Parallel Lines

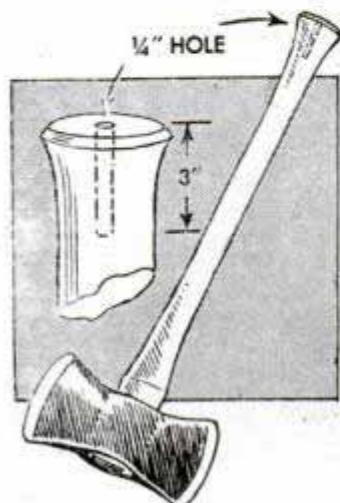


When a number of parallel horizontal lines of the same length are to be drawn, guide tabs attached to the underside of a T-square, as shown, will speed the operation. Addition of tabs, which are strips of cardboard held by drafting tape, also will minimize eyestrain for the draftsman.

Two Mechanical Brake Troubles That Are Easily Cured

When mechanical brake troubles are difficult to locate, the cause may be either a shifting of the axle due to a broken spring bolt or "frozen" anchor pins or bushings. Replacing the broken bolt and tightening all the parts involved will cure the first difficulty, and in the case of frozen parts, these should be freed and cleaned, after which the brakes should operate properly.

Olive Oil Stored in Ax Handle Prevents Drying of Hands



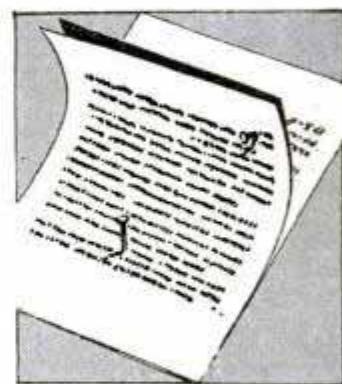
Lumbermen find that when they do much chopping during warm weather the skin of their hands becomes dry and cracked. To prevent this, one workman drilled a $\frac{1}{4}$ -in. hole 3 in. deep in the end of his ax handle, filled the hole with olive oil and then

plugged it. The oil gradually works through the ax handle and lubricates it so that the hands do not become dry.

Arthur L. Dufour, Queens Co., N. B.

Pins Aid Lining Up Original Page With Carbon Copy

Sometimes in typing it is necessary to make an addition to what has been written after the work has been taken out of the machine. If there is a carbon copy, it is difficult to align this with the original when putting the work back in the typewriter. To line up several sheets of paper, insert pins through two widely spaced periods on the original and stick the pins through the carbon paper into the same periods on the copy. When aligned, the papers are held and reinserted for typing.—Mallory Trent, New York.



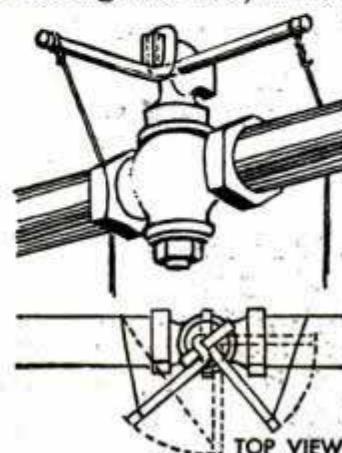
Drilling Overlapping Holes

In drilling a series of overlapping holes, as when removing the central portion of a die, mark off all the centers so that the holes will overlap slightly and then drill every other hole only. Force into each of the holes plugs cut from round stock of the proper size for a tight fit. After this, the overlapping holes can be drilled more easily without causing the drill to slip or break, and the uncut material can be removed easily.

Federico Strasser, Santiago, Chile.

Control Will Operate Stop Cocks

Opening and closing overhead stop cocks that are too high to be reached without a ladder can be simplified by attaching a wire-operated lever to the handle. Drill a hole in the handle for a length of rod, which is driven in and bent at right angles as indicated. File a groove at each end to hold the wire, then bring the wires over the pipe and allow them to hang down on the other side. The cock is opened or closed by pulling one of the wires.



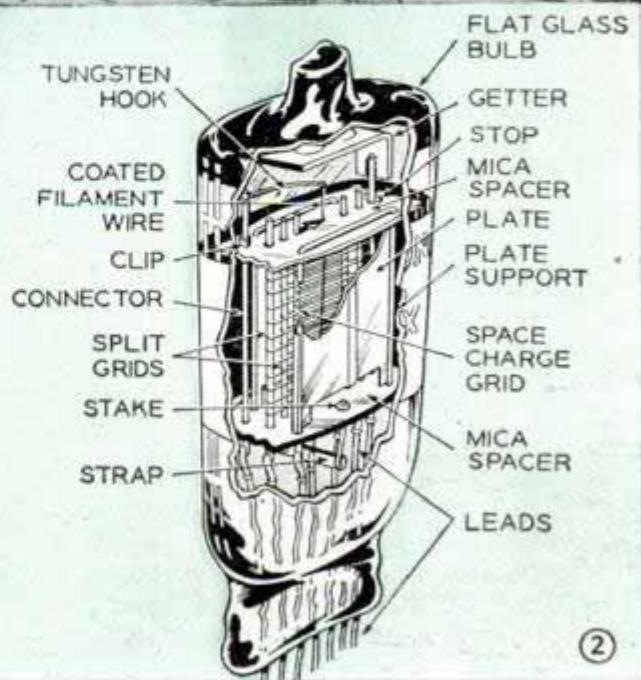
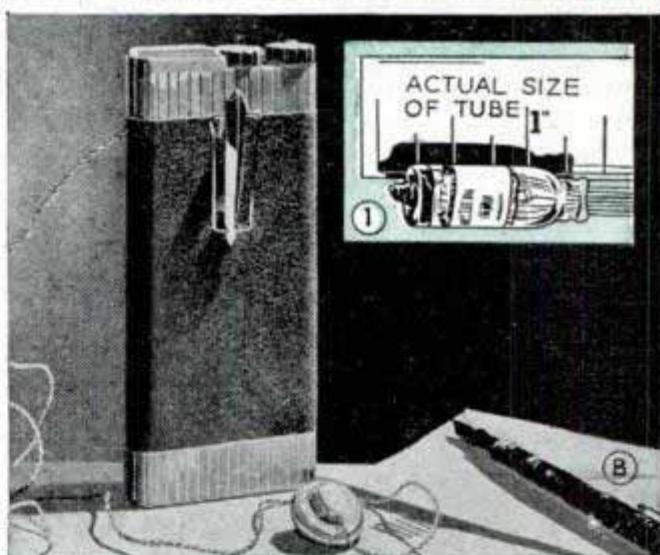


Five-Tube Super Pocket Radio

SUBMINIATURE tubes that made possible radar proximity VT-fuses in the noses of 5-in. shells which exploded automatically when they came within 70 feet of suicide plane and "buzz bomb" targets are now doing an excellent peacetime job in this ultracom pact pocket receiver. About the size of a modern hearing aid, this pocket set is only 3 in. wide, $\frac{3}{4}$ in. thick and $5\frac{1}{4}$ in. high, and, believe it or not, all batteries are included in the case.

The five tiny Raytheon plug-in tubes employed in the set have a total weight of about a half ounce, yet they perform all the functions of normal size tubes found in conventional 5-tube supers. They are slightly over 1 inch long, as indicated in Fig. 1; all elements and construction details are shown in Fig. 2. Of the five tubes used, two are r.f. amplifiers, one is a frequency converter, one a detector amplifier and the fifth an output pentode.

Designed to fit the pocket or purse, as illustrated in photos A and C, the set will be available in gold, silver and leather-covered cases. Retail prices will start at approximately \$30.00. The earphone is a small and inconspicuous "hearing aid" type; the antenna is combined with the phone cord appearing in photos B and C.



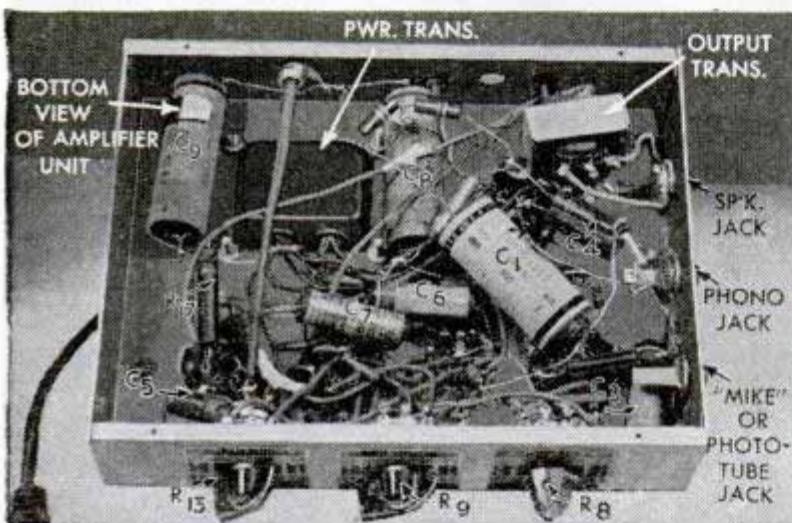
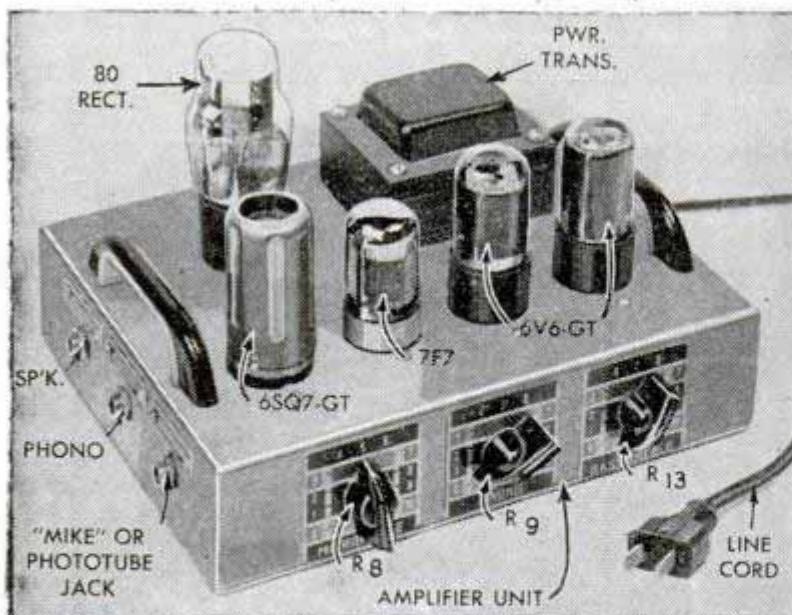
GENERAL PURPOSE "SOUND" AMPLIFIER FOR

By A. H. Ketzler

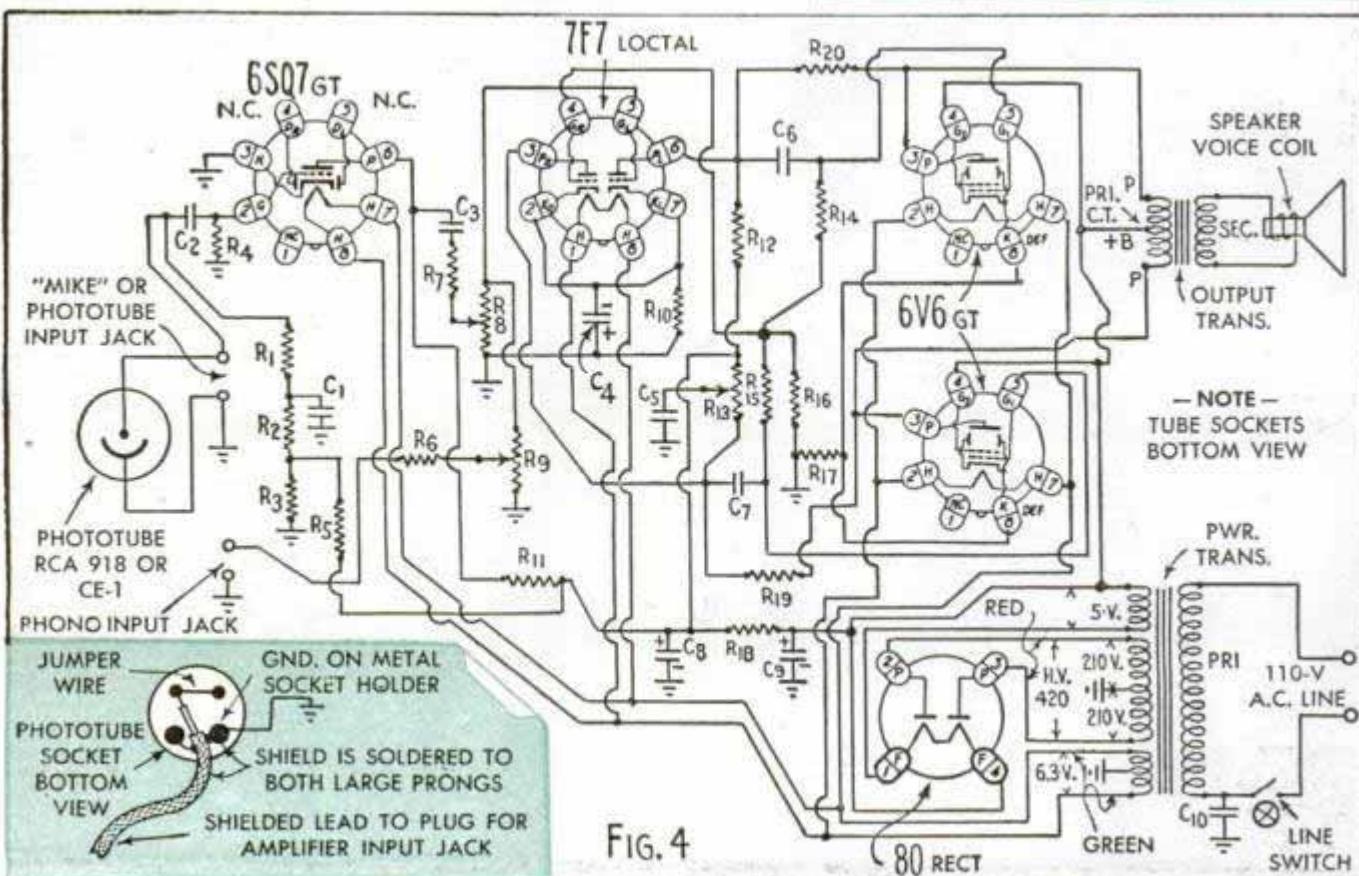
PART II

ALTHOUGH this audio amplifier originally was designed for use with the homemade sound head, described in the December issue, for converting an old silent home movie projector for sound, it also is ideal for other useful applications. It may be employed to amplify the output of a record player, and also provides a small public address system, as a microphone may be plugged into the phototube input jack when the operator wishes to address his audience for special announcements.

The amplifier is assembled on a sheet metal base 2 in. high, 7 in. wide and 9½ in. long. A front and top view of the completed unit appears in the photo at upper left; please note carefully the location of the various parts. The midget jacks for the input channels and



RESISTORS	
R1	= 1 megohm ½ watt
R2	= 100,000 ohms 1 watt
R3	= 100,000 ohms 1 watt
R4	= 5 megohms ½ watt
R5	= 150,000 ohms 1 watt
R6	= 250,000 ohms ½ watt
R7	= 100,000 ohms ½ watt
R8	= 1-megohm pot.
R9	= 1-megohm pot.
R10	= 1500 ohms ½ watt
R11	= 50,000 ohms ½ watt
R12	= 250,000 ohms ½ watt
R13	= 250,000 ohm pot.
R14	= 500,000 ohms ½ watt
R15	= 500,000 ohms ½ watt
R16	= 100,000 ohms ½ watt
R17	= 250 ohms 2 watts
R18	= 20,000 ohms ½ watt
R19	= 5 megohms ½ watt
R20	= 5 megohms ½ watt

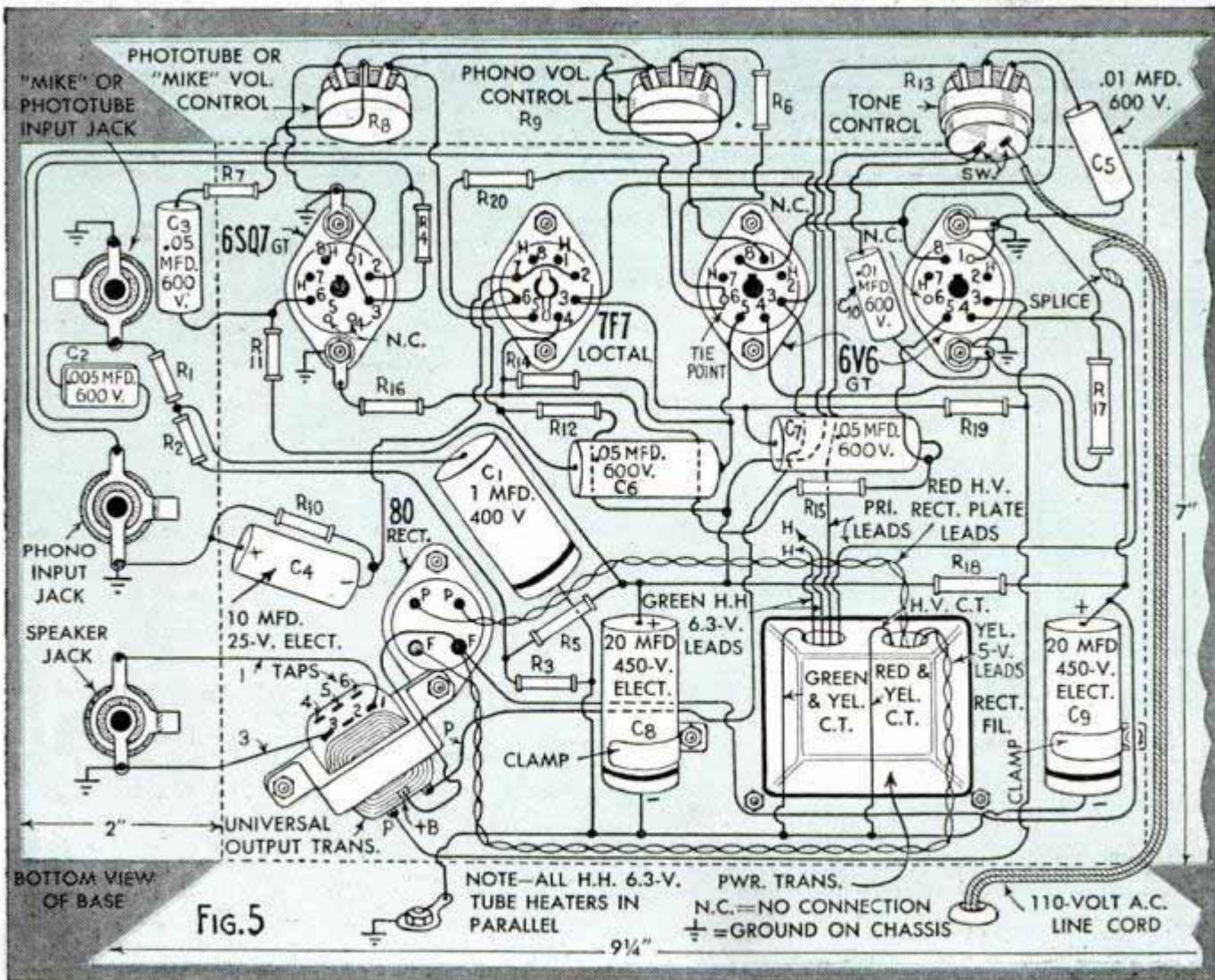
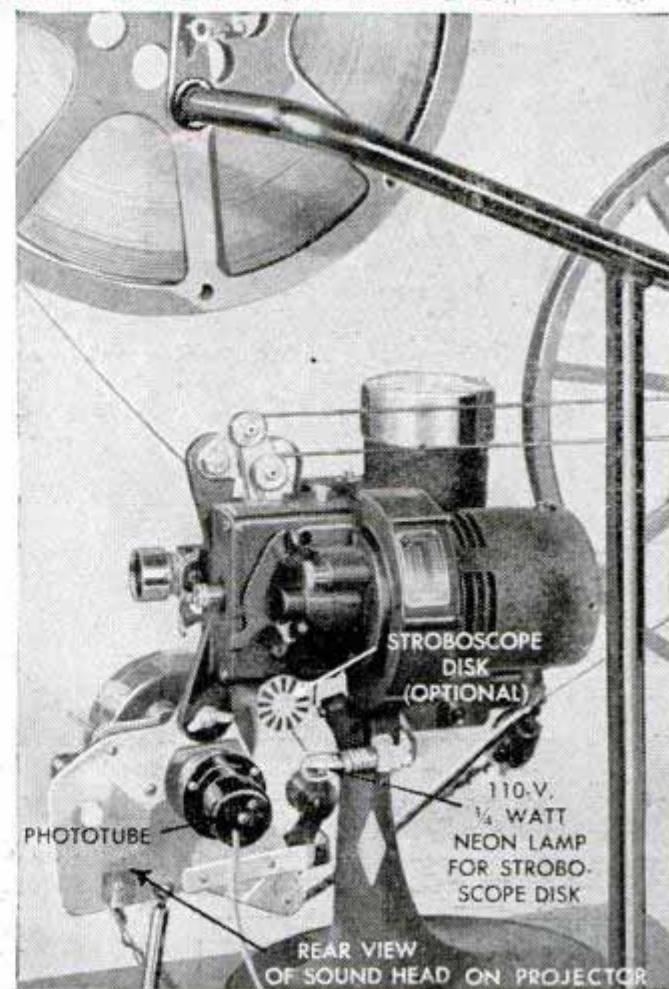


CONVERTED 16 MM. SILENT MOVIE PROJECTOR

separate speaker are lined up along the left-hand side of the chassis base. Volume controls R8 and R9 control each input channel separately; R13 is a combination tone control and line switch. A shield is used on the type 6SQ7-GT tube. The carrying handles, which are optional, come from the 10-cent store and are bright red plastic to match the control knobs.

A complete schematic circuit diagram for the "sound" amplifier appears in Fig. 4; the detailed pictorial wiring diagram is given in Fig. 5. This is an underside view of the base with the sides flattened out to show all parts in their relative positions. Referring to Fig. 2 in Part 1 it will be noted that the phototube socket is a 4-prong shielded Amphenol or similar type, provided with a mounting flange that is a part of the metal housing. The shielded lead comes out of the rear of the housing and terminates in the amplifier plug. All phototube socket connections are detailed in the bottom view at lower left in Fig. 4; the wire shield is soldered to both of the large prongs and grounded with a short wire to a machine screw in the metal socket holder.

(Continued to page 154)

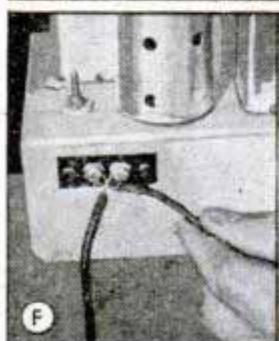
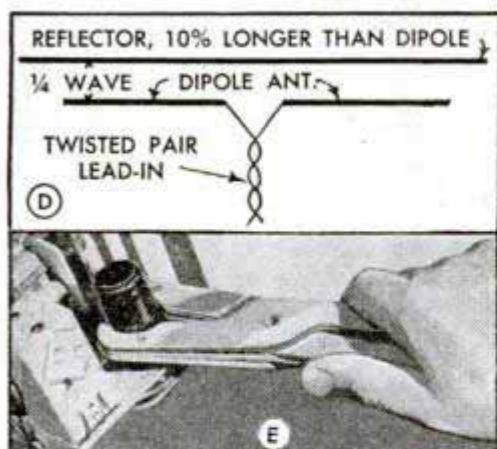


Helpful RADIO HINTS



PART REPRESENTED	COMMONLY USED CIRCUIT DIAGRAM SYMBOLS	
	RADIO DIAGRAM SYMBOL	INDUSTRIAL SYMBOL
CONDENSER (fixed)	— —	— —
RESISTOR (fixed)	—~~~~~—	RES
POTENTIOMETER	—~~~~~—	(C) OR RES
FUSE	—~~~~~—	F
IRON CORE CHOKER	—~~~~~—	~~~~~
IRON CORE TRANSFORMER	—~~~~~—	~~~~~ ~~~~~
RELAY CONTACTS (open)	— —	— —
RELAY CONTACTS (closed)	— —	— —

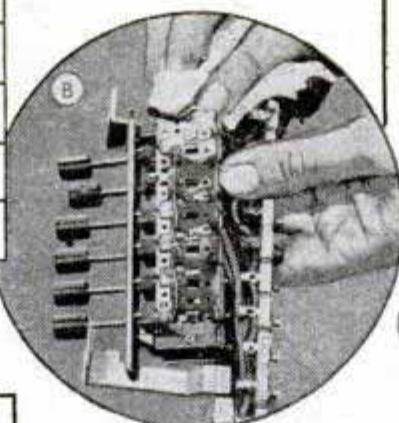
(D) FM dipole antenna may be made to operate in one direction by using a reflector parallel with its length



(G) Speaker plug always must be in socket before turning on set.

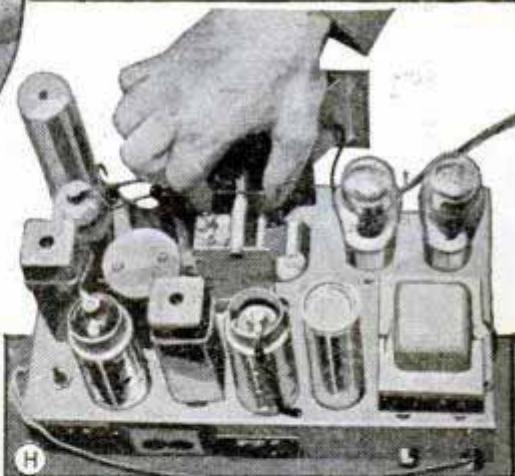
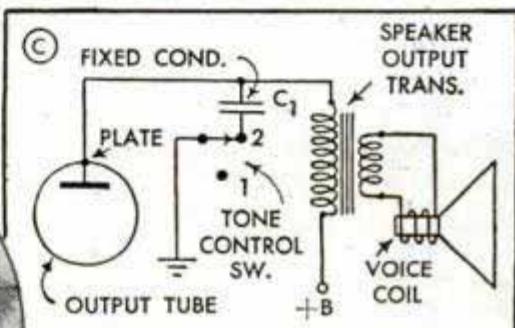
(I) Table dolly is handy for bench test set

(B) To clean switch contacts and wire-wound controls, some radio workers use Hoppe's gunpowder solvent, others carbon tetrachloride



(E) "Hot" metal tubes easily removed with an electrician's cartridge fuse puller. (F) Crackling noises in set may be caused by crossed antenna and ground wires

(H) Loose connections often are detected by moving variable condenser slightly



(A) Comparison chart for industrial electronic service men working with timing circuits, alarm systems and similar installations in which radio symbols are used in diagrams. (C) Simplest practical tone control circuit that may be connected between the plate of an audio amplifier tube and ground. Condenser C1 may be either .01, .002 or .005 mfd.; switch at position 2 increases bass response when desired

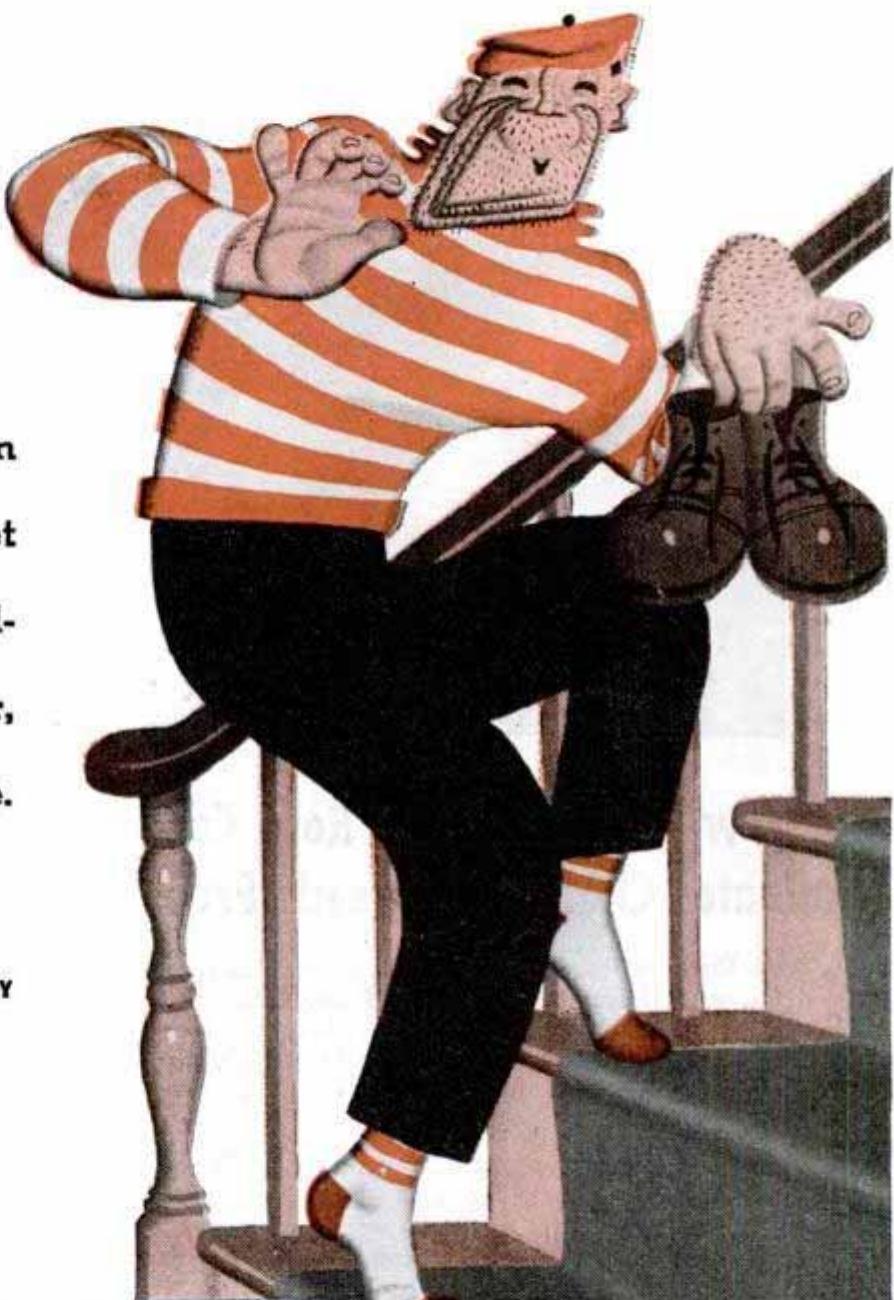
Tough but oh so gentle

When you install new piston rings, it will pay you to get Hastings rings. They stop oil pumping, check cylinder wear, restore engine performance.

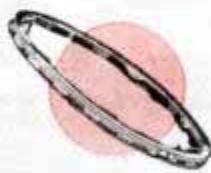
Ask your motor specialist.

HASTINGS MANUFACTURING COMPANY
HASTINGS, MICHIGAN

Hastings Ltd., Toronto



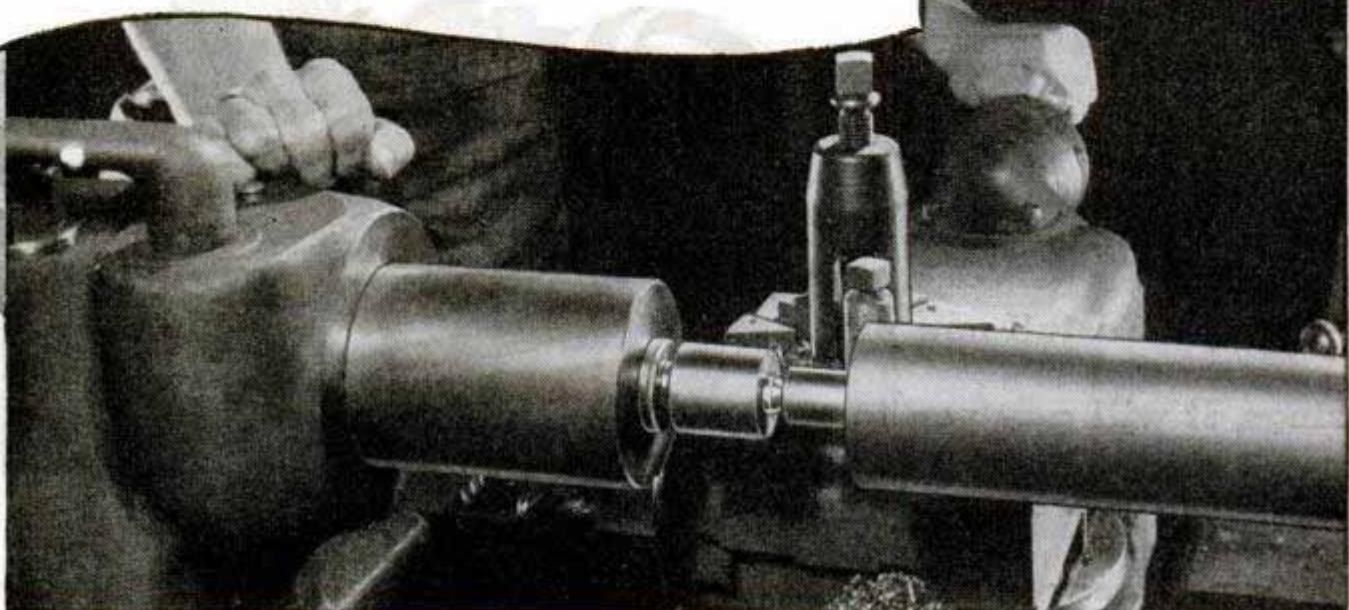
HASTINGS STEEL-VENT PISTON RINGS



TOUGH ON OIL-PUMPING GENTLE ON CYLINDER WALLS

Ingenious New Technical Methods

To Help You with Your Reconversion
Problems



New Precision Built Roto Center Eliminates Chatter...Speeds Production!

Now You Can replace dead centers on lathe and grinder tailstocks, with this new Keene live Roto Center—to increase production—to eliminate all radial play and possibility of chatter! Low in cost, the Roto Center is a high capacity unit, featuring many innovations to speed and improve quality of work!

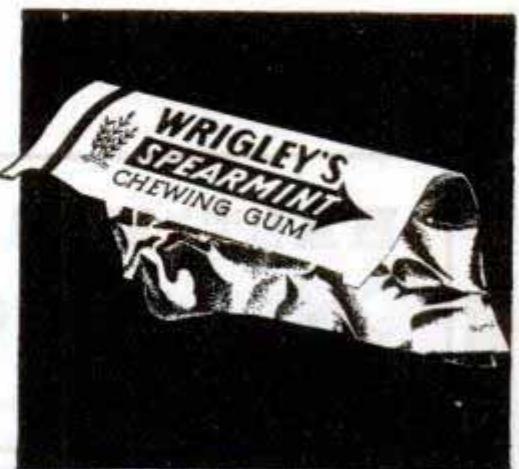
Matched roller bearings preloaded, are packed with high grade anti-friction grease at assembly. No attention is required for long periods. After assembly, runout is kept to absolute minimum—guaranteed less than .0002. Rear of center is tapped to receive standard hydraulic fitting. Chips, dust and cutting oil cannot reach bearings!

More and more peacetime "helps on the job" are returning to industry. One of these days, famous, flavorful Wrigley's Spearmint Gum will also be back to help you "on the job"—but only when we can assure Wrigley's Spearmint manufacture in *quantity* and *quality* for all. Today, we ask you to remember the famous Wrigley's Spearmint wrapper. Tomorrow, you may again enjoy Wrigley's Spearmint Gum quality and flavor while you are at work.

You can get complete information from
Keene Electrical Machinery Co., 549 W. Washington Blvd., Chicago 6, Ill.



The Keene Roto Center



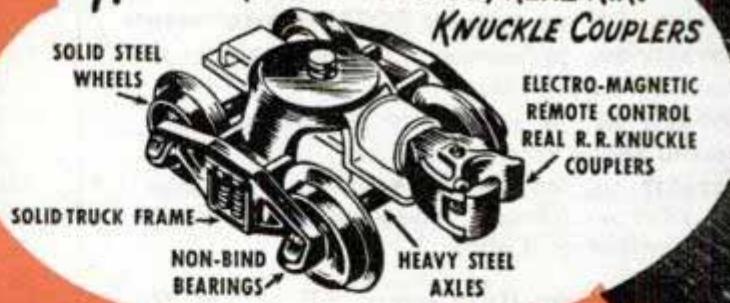
Remember this wrapper

LIONEL

TRAINS ARE BACK AGAIN

The New 1946 Lionel 4-car Freight Set is on the market in limited quantities. But MORE are on the way! Set features Brand New Electro Magnetic Real Railroad Knuckle Couplers, solid steel wheels, and die cast trucks. It is a beauty! Yet this is only a pre-view of the sensational surprises coming from LIONEL in 1946. (Insert shows new truck and coupler assembly.) Suggest you write for the two books below.

NEW! ELECTRO-MAGNETIC
REMOTE CONTROL, REAL R.R.
KNUCKLE COUPLERS



BOTH BOOKS FREE CLIP AND MAIL THIS COUPON NOW!



The Lionel Corporation
Dept. No. MB
15 East 26th Street, New York 10, N. Y.
Please rush my Two Big FREE Booklets!

Name.....

Address.....

City..... Zone No..... State.....

ROTAKIT



PRIDE OF THE INDUSTRIAL OR HOME CRAFTSMAN

sequence to the widening use of rotary files or "burs." And from inherent pride in good tools, every diligent user likes to have his rotary files in kit form. Nicholson offers—

A choice of three popular ROTAKIT assortments

ROTAKIT No. 20 contains 10 assorted Nicholson Hand Cut Rotary Files.

ROTAKIT No. 30 contains 10 assorted Nicholson Ground Rotary Files.

ROTAKIT No. 40 contains 5 assorted Nicholson Hand Cut and 5 assorted Nicholson Ground Rotary Files (as illustrated above).

Nicholson guarantees every Nicholson Rotary File made from high-quality, high-speed steel; keen, accurate cut; true-centered shaft and perfect radius at all cutting circumferences.

For ROTAKIT, or any individual assortments, contact your mill-supply house or leading hardware dealer.

NICHOLSON FILE CO., 22 ACORN ST., PROVIDENCE 1, R. I.
(In Canada, Port Hope, Ont.)

NICHOLSON
ROTARY FILES
(Hand Cut and Ground)
FOR EVERY PURPOSE

NICHOLSON
U.S.A.

Aussie "G Idea Pool"

(Continued from page 87)

lying around his camp. He made a container with a hinged lid in an hour and told the Inventions Directorate about it. They redesigned it as collapsible and reusable and it became a standard army package.

The Army Inventions Directorate was asked to devise a way of dropping packages so that they would land exactly where required. One line of inquiry developed a container attached to a lopsided revolving vane, on the principle of the sycamore seed. That was good for weights of 40 pounds. But to drop accurately 200-pound packages, a new idea was tried—the "Storpedo." Shaped roughly like a torpedo, it is made of compressed paper with a shock-absorbing percussion head at one end and a parachute pack at the other.

There have been dozens of other ideas that paid off. One was for a nonpoisonous dye to camouflage faces and hands of Australian infantrymen in jungle fighting. It had to be made in large quantities; it had to be nontoxic and in a waterproof container; it had to be readily soluble in cold water, yet adhesive enough to stick to the skin despite continual sweating. The Inventions Directorate got it.

Here are a few of the valuable nonsecret items sponsored by the Directorate and accepted by the Services:

A time-service chronograph which makes it possible to synchronize time signals throughout the Australian Commonwealth and Australian combat zones.

Sliding clasp fasteners which can be made to hold materials so that they are watertight and airtight.

Colored smoke signals.

A device composed of two mirrors to enable distressed persons to focus a flash of sunlight on a friendly ship or plane.

Nonslip boot fittings for walking on wet, sloping logs and up slippery banks.

Waterproof maps.

**Model Builders
Attention!**

	V	V-2	V-3
Hex	1/2"	3/8"	5/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	5/32
Weight, Grams	8	3 1/2	2 1/2

Champion spark plugs for model gas engines give the same dependable performance as regular Champions. Sillment sealed. Sillimanite insulator. Alloy needlepoint electrodes for easy starting. One piece construction.

CHAMPION

SPARK PLUG COMPANY • TOLEDO 1, OHIO

Type of 6-engine Clipper Pan American World Airways will place in service in the future.



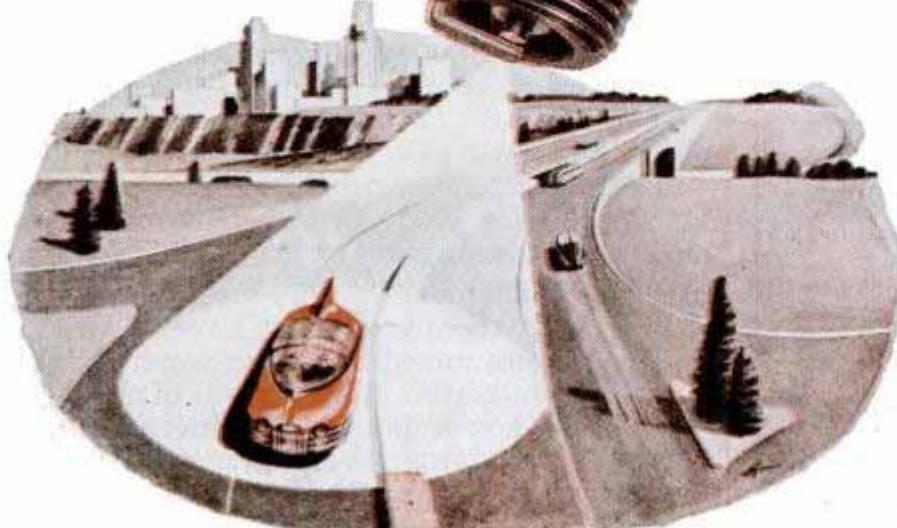
New Horizons...

IN SPARK PLUG PERFORMANCE!



Wartime necessity produced technological advances in Champion Spark Plugs which were outstandingly evident in the performance of the most advanced aircraft engines. Equally great strides were made in Champion Spark Plugs for other engines.

Today, there are new horizons in spark plug performance for your present car, if you insist on dependable Champion Spark Plugs. The unequalled manufacturing facilities and experience exclusive to Champion are back of every Champion Spark Plug. That's why it will pay you to insist on Champions—the automotive spark plugs with aircraft prestige and efficiency. Champion Spark Plug Company, Toledo 1, Ohio.



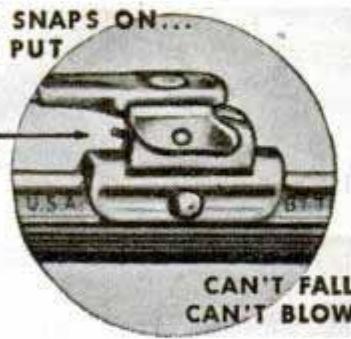
DEPENDABLE
CHAMPION
SPARK PLUGS

ANCO RAIN-MASTER

"Dead-Locker"

WINDSHIELD WIPER
ARMS and BLADES

BLADE SNAPS ON...
STAYS PUT



(A war-born invention—by ANCO—first
for military aircraft—now for your car.)

DON'T SHOOT YOUR GAS-PUMP MAN!

He's doing the best he can. Sure, he knows how dangerous it is for you to drive your car... in stormy weather... with your dull old windshield wipers that smear and smear. He'd gladly put on for you quickly a pair of keen new ANCO RAIN-MASTER Wiper Blades and Arms. He has them—Newest Models! But he forgets to remind you? Too busy? You can't shoot him for that!



After all, it's *your* car to protect. So you remind him. Get RAIN-MASTERS... patented features... original equipment on many makes of high grade cars and trucks... used in war—on our fighting tanks and trucks and ships and bombers too... because ANCO RAIN-MASTERS clean quicker, clean cleaner... last longer. May save you a costly smashup.

Ask for RAIN-MASTER Windshield Wiper Arms and Blades next time you buy gas.

Navigation for the Sky Tourist

(Continued from page 62)

by a much wider line. For reasons such as these, aerial navigation maps are designed so that certain features which are useful for navigation are accentuated, and other and less useful details omitted. For example, on the great plains, unpaved section roads are spaced one mile apart; there would be no point to putting these roads on a map (eight of them to each inch) and thus obscuring far more important landmarks, such as rivers and paved highways. Maps, therefore, use conventional symbols to represent ground objects such as railroads, rivers, power lines and towns, and before you can understand what you are doing in contact navigation you must have a very good knowledge of these symbols.

To read a map easily, it must be oriented correctly. That is, it must be lined up so that everything to the right of your course on the map is to the right of you on the ground. To do this you align the course with the fore and aft axis of the plane, and this insures that you will see the ground detail exactly as you see it on the map.

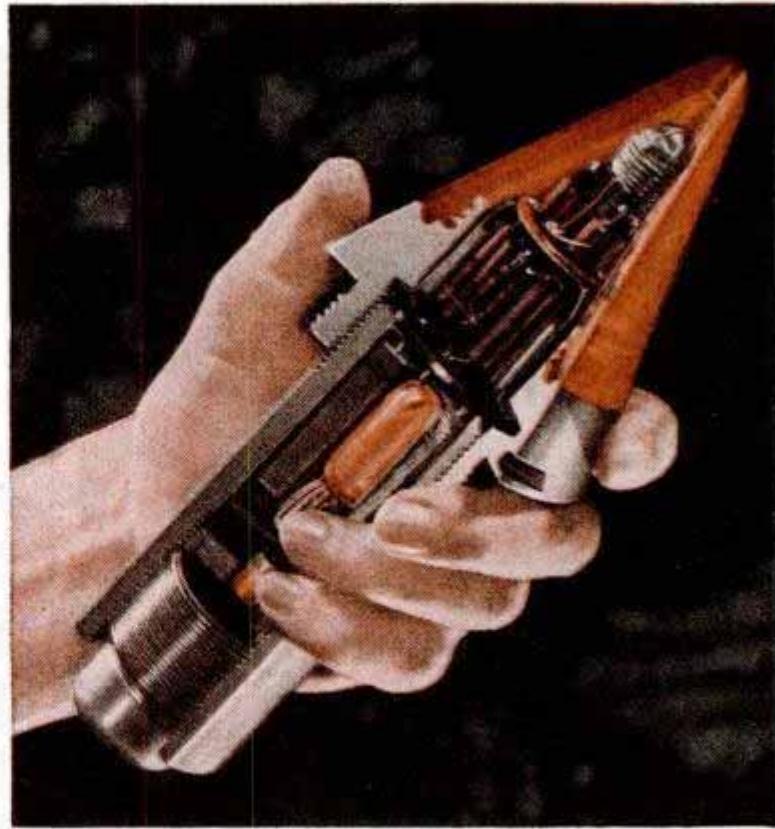
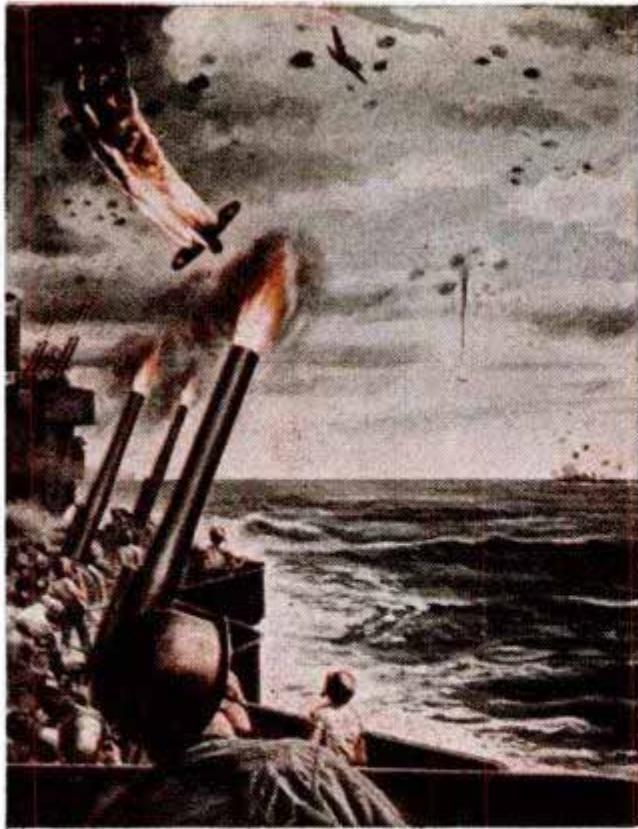
There is a definite map reading sequence—watch, map, ground. You must not, if possible, read from the ground to your map, because if you do your mind will try to fit a map detail to one you saw on the ground, whether or not it matches. For example, if you see a crossroad involving two paved highways just below you, and start looking for it on the map, you may see several road crossings which look as if they might fit—and you can be sure that your subconscious mind will pick out the one closest to the point where you want to be, instead of where you really are.

Instead you first look at your watch, then at the map. The five-minute intervals will tell you just where you should be, so that you can look around this point on the map and pick out details that you may expect to see before you on the ground, either now or in a few minutes. You next decide on just what the map details will actually look like. Then you look ahead of you, and to either side, and try to pick out some of these landmarks. Remember, to either side, because you are very likely to be a few miles off course, either to right or left.

Time markings are very useful. If you didn't have them you would have to watch map and ground all the time when flying over unfamiliar territory for fear of missing one of the few pinpoints available, and that would make flying drudgery, instead of the fun it really is. With the five-minute inter-

(Continued to page 152)

THE ANDERSON COMPANY
Established 1918
GARY, INDIANA

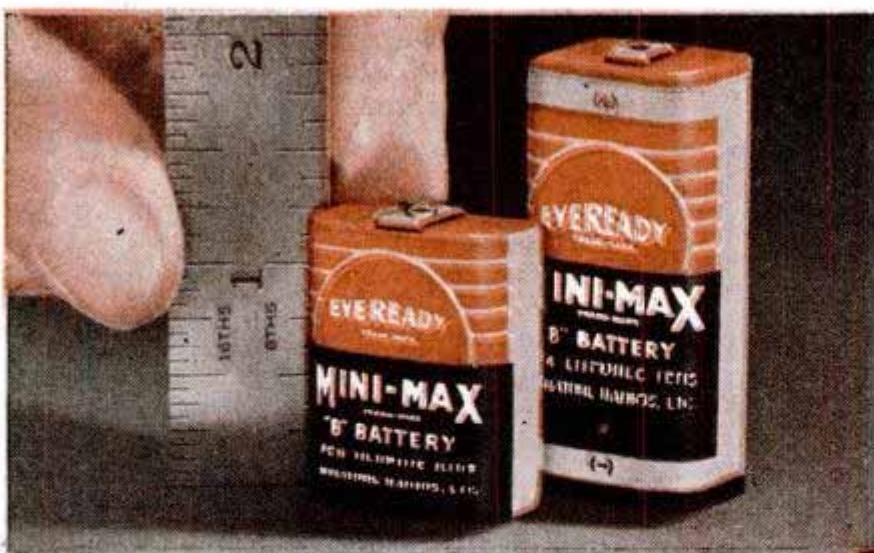


DEATH IN THE AIR. Many a Jap pilot, spinning down in flames from high over an American warship, quite literally never knew what hit him. Neither did enemy intelligence, bewildered by the accuracy of Allied gunnery.

FIVE-TUBE RADIO transmitter and receiver, in the fuse of the shell, is the brain of the secret weapon. In flight, the transmitter broadcasts a continuous radio wave. Reflected back from the target, this wave explodes the shell at exactly the right moment!

THE SHELL WITH A "RADIO BRAIN"

Army, Navy lift censorship on mystery weapon that licked V-Bomb, Kamikaze attacks



TYPICAL of "Eveready" "Mini-Max" power is this 15-volt hearing-aid battery. Small, light, economical, it makes possible lighter, easier-to-wear hearing aids. It is now available.

"CIGARETTE-CASE" RADIOS, small enough to wear, are made possible with this "Mini-Max" Battery. It packs 22½ volts into a package smaller than a standard box of safety matches!

NOT EVEN the Atomic Bomb was more "hush-hush" than the "Variable Time Radio Proximity Fuse"—a fuse mechanism that decides for itself when to explode; requires no advance setting.

Transmitter, receiver, and detonating mechanism all draw power from a tiny "Eveready" "Mini-Max" battery: a "powerhouse" rugged enough to withstand the shock of the gun's discharge: a force 20,000 times that of gravity!

EVEREADY
TRADE-MARK

MINI-MAX
TRADE-MARK

The registered trade-marks "Eveready" and "Mini-Max" distinguish products of National Carbon Company, Inc.

The Man Who Wouldn't Stay Licked



*So inconspicuous

...and so, Bill, I'm back on top again. Yet, only a year ago, I thought I was licked because my hearing had gone bad.

It must have been failing for years but I wouldn't admit it. Then came the day when I said "no" on a big deal when I should have said "yes."

After that, I went to an ear specialist. He recommended a hearing aid. Fortunately, I tried a new Zenith.

So, now I'm sitting pretty, hitting on all eight cylinders. Yep, Bill, I can hear again, and the world's my oyster...

* * *

If you want to start friends or relatives who are hard of hearing back on the road to happiness—suggest that they visit a Zenith dispenser and try a new Zenith Radionic Hearing Aid. You owe it to them. They want to hear you but it's embarrassing when you shout.

Their own ears will decide—no one will ask them to buy. And the new Neutral-Color Earphone and Cord is so inconspicuous. Remember—Zenith has always stood for quality.

Choice of Amplifier Colors at no Extra Cost.

Super-powered Model A-3-A \$50

Model B-3-A (Bone Conduction) \$50

Standard Model A-2-A \$40

THE NEW
ZENITH
RADIONIC
HEARING AID

BY THE MAKERS OF ZENITH RADIOS

PASTE ON PENNY POSTCARD AND MAIL

ZENITH RADIO CORPORATION, Dept. PM-1B
6001 Dickens Avenue, Chicago 39, Illinois

Please send me FREE booklet about the Zenith
Radionic Hearing Aid.

Name _____

Address _____

City _____ State _____



vals you can forget about map reading for reasonable lengths of time, knowing that when you consult your map again the intervals will tell you just about where you are—providing, of course, that your flying has been accurate.

In spite of all these contact navigation aids, every so often you will get lost. Providing that you know what to do, this is nothing to worry about. The procedure is simple. Go back on your map to the last pinpoint of which you were sure, and work out how far you have gone from there and in what direction, knowing your air speed and approximate ground speed and course. You can estimate, knowing how well you have been flying and whether there has been any noticeable wind shift, just about how many miles you could be out, and this gives the radius of your circle of uncertainty—that is, you must be somewhere in the circle drawn with your calculated position as center, and possible error as radius. Then you fly on until you reach any landmark which, although unfamiliar, could be recognized on the map. Remember that your circle of uncertainty has moved as you continued to fly on the original heading. Now fly a square around the landmark (not a circle, because it is impossible to orient a map unless you fly in a straight line) as high as the visibility and cloud base will permit. Eliminate carefully the possible locations on the map within the circle of uncertainty until you find the one it must be. This can be checked by continuing on your original heading and making sure that the subsequent landmarks are consistent with the pinpoint that you have decided is correct. If, during your search, you couldn't identify the landmark, then fly on to the next one and start over again. In time, you are sure to find your position.

There are, of course, many other procedures for use when lost, but this is probably the best. But keep that "in time" in your mind. The average light plane can sit down in almost any fair-sized field; if you are thoroughly lost pick a good one, land, and ask the nearest farmer. Don't let your gasoline supply get low while you desperately try to locate yourself; pick a landing ground while you still have enough fuel to choose, and your precautionary landing will be both safe and sensible.

Estimated to be 80,000 times as bright as the sun, a new star which is 8300 light years (49,000,000,000,000 miles) from the earth was discovered recently in the constellation of Aquila by the Dominion Observatory at Victoria, B. C.

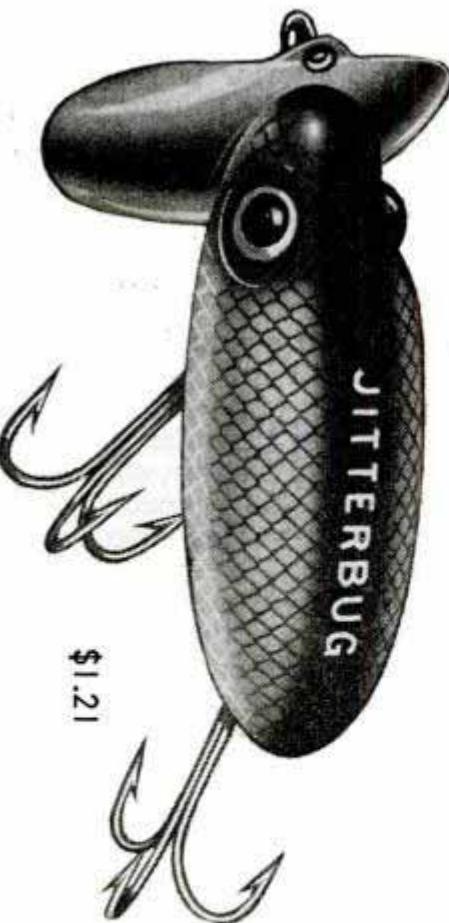
Get Michigan Limit of Largemouth with JITTERBUGS

Clarke Brothers
Detroit, Mich.

"Dear Fred—I was using a frog finish Jitterbug and my brother a scale finish Jitterbug when we caught this limit of Michigan largemouths from Power Dam Lake on the Betsie River in Benzonia County. Thought you would like to know that my gang are now all 'Jitterbuggers'."—Dr. Maurice W. Clarke, Detroit, Mich.

SEND FOR FREE CATALOG

Gives all the latest information on Jitterbug, my famous surface bait, plus my family of Hawaiian Wigglers.



\$1.21

It's Time to Open the Shutters

(Continued from page 48)

Here is a stunt for making color prints in half the usual processing time, if your camera uses cut film. Cut a piece of color printing paper to size in the darkroom and load it in a holder, then expose it just as if you were using regular film. The exposure needs to be several times more than with color film so you should make several test shots, recording the data for each, to determine the proper exposure. Color papers are designed for use with artificial light and so if you photograph an out-of-doors scene you should use a correction filter of the type required when exposing "indoor" color film outside. After exposing the color paper in the camera, develop it according to the standard directions for its type.

The new techniques that are required for processing color materials are leading to the designing of much new darkroom equipment, one item of which is a rotary development tank for color papers. In this machine the color sheets to be developed are locked onto the perimeter of a plastic reel that hangs inside a round tank, after which a light-tight top is put in place. Solutions are poured into the tank through a light-trapped funnel and drained with a hose. A motor outside the tank rotates the reel, providing even, positive movement of the color material through the liquid bath. The tank permits use of minimum amounts of solutions. Its interior is rubberized to avoid contaminating the solutions.

General Purpose "Sound" Amplifier

(Continued from page 143)

The single insulated conductor then is soldered to the small socket prongs which are connected by means of a jumper wire. The shielded lead to the amplifier plug should be no longer than necessary, as the amplifier is placed near the projector. A 25-ft. two-conductor rubber insulated cable is used to connect the speaker, which is housed in a standard speaker cabinet that may be placed either at the side or directly behind the movie screen. Any good 6 or 8-inch permanent-magnet speaker may be used; the push-pull output transformer in the amplifier is a universal tapped type.

Solder all connections carefully, especially the ground connections made on the chassis base. The green 6.3-volt heater leads H and H go to the socket terminals marked H to connect the tubes in parallel just as shown in Fig. 4. The power trans-

(Continued to page 156)



Don't Drill without this new *Protector & Depth Gauge*

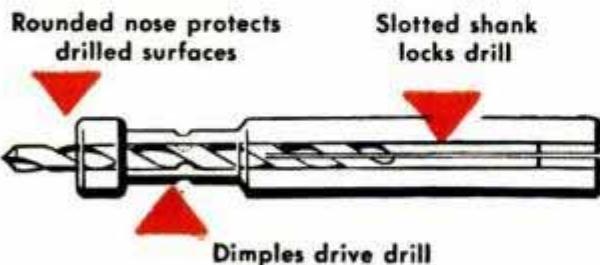
Ends Drill Breakage

Now you can drill faster—and not worry about drill breakage. And you can do more accurate work. The new, precision-made Hartwell Protector & Depth Gauge reinforces drills, prevents them from bending or breaking. It is also a *depth gauge* and *stop*...can be used to measure depth of holes or to limit travel of your drill when you are drilling through thin material. It is available in 15 selected sizes, 1/16 through "F", and fits standard drill chucks.

HARTWELL Engineering Company

Designers • Manufacturers • Distributors
3417 Crenshaw Boulevard • Los Angeles 16, Calif.

FREE: "Home Drilling Guide" for users of breast and portable power-driven drills. Write to above address.



GET IT AT YOUR HARDWARE STORE

...look **SHARP**
feel **SHARP**
be **SHARP**
use **Gillette**

**Blue
Blades**

*with the
SHARPEST
edges
ever honed!*

**5 for
25¢**

Copr. 1946 Gillette Safety Razor Co.

GILLETTE'S CAVALCADE OF SPORTS presents the major boxing event of the week every Friday night over American Broadcasting Company stations at 10 o'clock E.S.T.

Gillette Safety Razor Company, Boston 6, Mass.

NO NEED OF THIS . . .



This gentleman is the inventor of the "inside-outside" pipe. (From an old print)

**WHEN YOU'VE GOT
A SWEET SMOKING**

LHS

STERNCREST

STERLING

There are no tricks nor hocus pocus in pipe-making. All you need are the finest materials, a style sense, and pipe "know how". LHS has them all. You can own an LHS from \$1 to \$10. At your dealer's.

Other LHS Pipes

LHS Sterncrest Ultra-fine.....	\$10.00
LHS Sterncrest 14K.....	7.50
LHS Certified Purex.....	3.50
LHS Purex Superfine (Domestic Briar).....	1.50

\$5

Model No. 46. Plain Finish. Dozens of other hands some models in Plain or Antique Finish.

**IMPORTED
BRIAR
STERLING
SILVER
BAND**

BUY VICTORY BONDS

LHS
PIPS

Write for "Pipes
—for a world of pleasure" FREE.

L & H STERN, INC., 56 Pearl Street, Brooklyn 1, N.Y.

former is a half-shell type having a 420-volt center-tapped H.V. (high-voltage) secondary winding, a 6.3-volt 3.5-amp. tube heater winding and a 5-volt 3-amp. winding for the rectifier tube. Do not use a power transformer with higher voltage than the 420 volts specified in this type of circuit. In other words, do not exceed 210 volts each side of the center tap. This is a comparatively inexpensive type of audio amplifier but the results were highly satisfactory and the volume is sufficient for the average size room where home movies are shown.

A small stroboscope disk which appears on the projector in the photo at upper right on page 143 is entirely optional, but it provides a means by which the operator can adjust the speed of the motor so that segments appear to be stationary when the film travels through the projector at exactly 24 frames per second. The disk is $1\frac{1}{8}$ in. in diameter and is made of white cardboard glued to a thin metal disk which is mounted on the end of sprocket shaft E. The black and white segments are equal in number. In this case there were 13 of each and the film speed is slightly less than 24. Actually there should be 12 of each to obtain a more accurate speed reading in this particular case. There is a perforation hole for every frame, and sound film travels 24 frames per second, therefore 24 multiplied by 60 equals 1440 frames per minute. Sprocket E has 5 teeth, therefore 1440 divided by 5 equals 288 r.p.m. A small neon lamp operating on the 110-volt 60-cycle line is mounted on the projector frame in front of the disk. As the number of light flashes are 60 per second there will be 3600 flashes per minute; this divided by the r.p.m. (288) indicates 12 segments. Detailed student material list R-340, including both the sound head and amplifier components, is available from Popular Mechanics radio and electronics department upon receipt of ordinary letter postage.

Wall Plug Serves as Night Light

A new wall plug serves as a combination safety pilot or night light, convenience outlet and appliance cord cap. A tiny bulb inside the plug emits a soft glow through the front of the unit for convenience in locating the receptacle in dark locations. The plug can be adapted as a cap for the end of a cord to an electrical device.



Most makes of power tools look alike — but...
advanced engineering features of
DELTA-MILWAUKEE POWER TOOLS
mean greater operating satisfaction

1 Lubricated-for-life Ball Bearings. You don't have to worry about oiling these bearings — they're lubricated for life when they leave the factory. And they are double-sealed against harmful dust, to assure you of longer bearing life.

2 Pre-loaded Bearings. This is the result of an extra manufacturing operation that reduces the "play" in the bearings, to help you enjoy long-time operating efficiency and accuracy.

3 Precision-bored Bearing Seats. These bearing seats help keep all parts lined up properly, so that you have greater assurance of producing finished pieces exactly according to dimensions.

4 Precision-ground Shafts. These are shafts built to run without any "wobbling" which might throw off your measurements.

5 Dynamically-balanced Pulleys. The pulleys which transmit the power from your motor to your power tool are balanced to help eliminate annoying, damaging vibration.

Ask your Delta dealer to let you know when he receives his first shipment of these famous power tools. Then, see how they are built to help assure you of accuracy, dependability, safety, economy. Or place your order with your dealer now, so that you can be among those to receive delivery at the earliest moment.

A Whole Year of Woodworking Fun, Projects, and Ideas

for
only. **50¢**

... in **THE Deltagram**

... the popular, plan-packed homecrafters' magazine



Delivered to your home six times a year. Page after page of fascinating, shop-tested plans and projects helpful in producing beautiful objects your friends admire. Ideas, news, shop tips on performing woodworking operations more easily, more quickly, more safely. Crystal-clear, step-by-step instructions in

words and pictures.

The new subscription year for The Deltagram has just started. By subscribing right now, you're still in time to receive the first new issue. Fill out the coupon below and mail it today with coin, postal note, or money order. Only 50¢ for all six exciting issues!

Delta
MILWAUKEE
POWER TOOLS



TEAR OUT COUPON AND MAIL TODAY!

THE DELTA MANUFACTURING COMPANY
681A E. Vienna Avenue, Milwaukee 1, Wisconsin

Enclosed is 50¢ in payment for a full year's subscription to The Deltagram.

Name _____

Address _____

City _____

(____) State _____

NEXT TIME SAY
BRIGHT STAR

and you will get a
FLASHLIGHT & BATTERIES
famous since 1909
for **QUALITY,**
STYLE and
SERVICE



BRIGHT STAR BATTERY CO. CLIFTON N. J.

FIDO Fights Fog

(Continued from page 15)

and by the Massachusetts Institute of Technology and Columbia University. The final tests are being made by a staff of experts under the direction of Lieutenant Robert L. Champion, Navy fog dispersion authority. One possibility is the finding of a way to clear the air over the deck and to the lee of a carrier that is running in dense fog. Another possibility is the perfection of an inexpensive method of fog dispersion suitable for use at air line terminals.

Using sonic generators to turn fog into rain to increase visibility is one thing being done at Arcata that disputes Mark Twain's remark that everybody talks about the weather but nobody does anything about it.

Sonic generators are immense sirens that produce a tremendous roar. Such sirens with giant wooden horns were audible 90 miles away when mounted on a California mountain top in one series of tests. A person's eardrums would be broken if he walked in front of one of these sirens. Birds are knocked out of the air a block away. The noise tingles the soles of your feet when standing beside the machines.

Tests so far show that the sonic method can create almost 100 per cent increase in visibility; that is, visibility of 100 yards is increased to 200 yards after the generators are turned on. The intense vibration bumps fog particles together, forming rain and decreasing the amount of fog in the air. At Arcata, six sonic generators are banked at each side of the runway at the windward end and will be tested for fog dissipation and for preventing the encroachment of fog on the runway. Not at all comparable in efficiency with heat at present, the sonic generators are objectionable for commercial installation because of their noise.

Ejecting a long thin wind curtain of hot air up from the ground to evaporate fog as it drifts toward the field is another idea that Lieutenant Champion and his staff will try out. Somewhat similar will be a water curtain in the form of a vertical sheet of spray that is shot 100 feet into the air to absorb fog particles as they are brought in by the wind. As much as 50,000 gallons of water per minute may be sprayed into the air experimentally, an amount that might create drainage problems at some fields but that probably would be no problem for most marine installations.

Powdered drying agents also will be sprayed into the air to observe their effect on fog. Some of the desiccants are known

(Continued to page 160)

VanRoy

with the new

Ajustomatic STEM



*The one and only
Pipe of its Kind*

VanRoy Ajustomatic is more than just another screw-stem. It is a totally new kind of pipe. New—because the patented stem is "float-mounted"—accurately lines up with the bowl as straight as a die, always. The stem can be turned as often as you like—it will never lock at an off angle. Give yourself, or another, the proud satisfaction of owning this latest—and greatest—achievement in VanRoy pipes.



SIGNET OF QUALITY IN PIPES

VANROY COMPANY, INC., Empire State Building, New York 1



All For \$13.00

List Price

See your dealer or write us

SPINTITE SET

A Positive Need in Every RADIO,
HOME and ELECTRICAL SHOP.

Contains Chuck Type Handle, Reamawl, 3 Screw Drivers,
2 Pliers, 7 SPINTITES and Insulated, **WALDEN**
Neutralizing Alignment Wrench.

WORCESTER

WRENCHES

STEVENS WALDEN, INC.

WORCESTER 4, MASSACHUSETTS

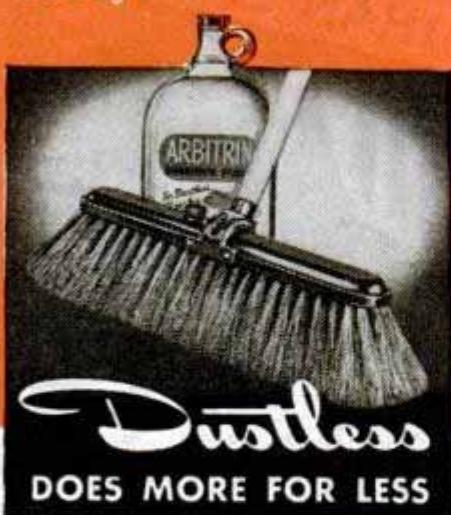
WRENCHES





STOP DUST

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to be effective although some also are extremely corrosive to aircraft metals. High-intensity lights are to receive a thorough testing for their fog-penetration qualities. All these ideas will be tried separately and in combination with each other and with the FIDO installation. The field also is one of the main test stations for new types of radio and radar landing aids.

The FIDO apparatus at Arcata consists of test lengths of different designs of burners, some of which are high-pressure types, some carried in open trenches, and some which emit their flames through slots in the ground. One slotted design is used to cross taxi runways leading from the field and is provided with quick shut-off valves so that the flames can be turned off when a plane is taxiing across the flame line. Each unit of burner length has its own electrical ignition and each is controlled from the field's control tower. A typical burner line creates a solid bank of flames two feet high.

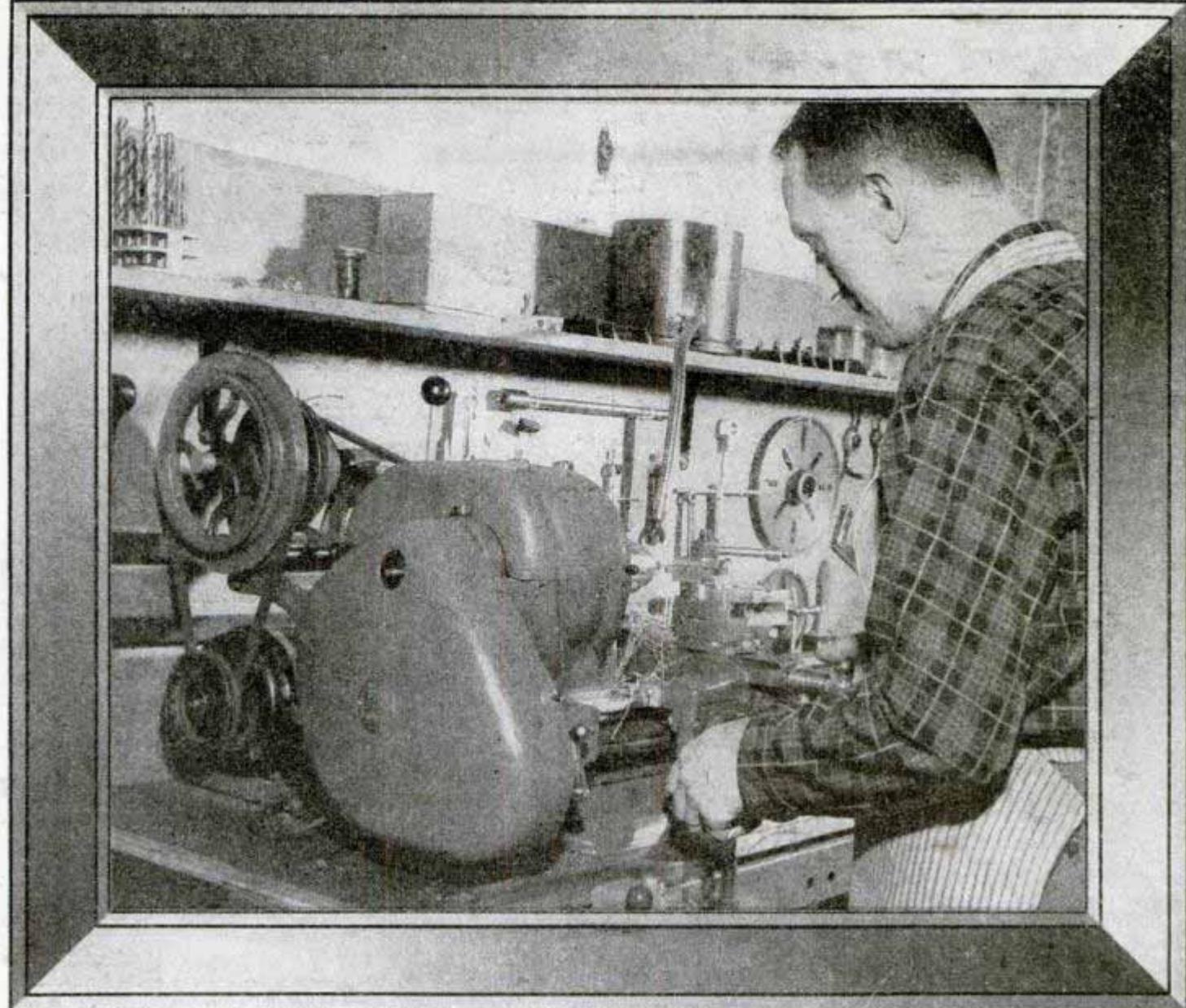
FIDO burns a hole through several hundred feet of fog in five minutes and requires about 20 minutes to open up a large hole through 2000 feet of fog during a high wind. High winds, however, are not often associated with dense foggy conditions, nor is an unlimited ceiling necessary for normal visual landings after the heat has created a down-wind visibility of several miles with a ceiling of several hundred feet.

The cost of operating FIDO still amounts to several hundred dollars for landing one airplane, but Arcata is testing a new high pressure burner that uses Diesel fuel oil. Developed by Babcock & Wilcox Company, the Diesel oil burner may reduce fuel costs to \$150 per plane and possibly twice that amount for keeping a field open long enough to bring in a number of planes.

Atomizing the fuel instead of vaporizing it, the Diesel fuel installation operates at pressures up to 1500 pounds per square inch and produces an intense bushy flame with a minimum of smoke under adverse wind conditions. The nozzles, small steel tubes, are buried almost flush with the ground and require only simple bar guards for protection.

Air terminal and air line officials are interested in this development. A FIDO installation that burns inexpensive fuel oil instead of high priced gasoline may make it possible to operate air liners steadily on schedule in any weather.

At least 96 percent of all American colleges and universities now recognize aeronautics as an elective science, and about half the schools accept it as a laboratory science for entrance requirements.



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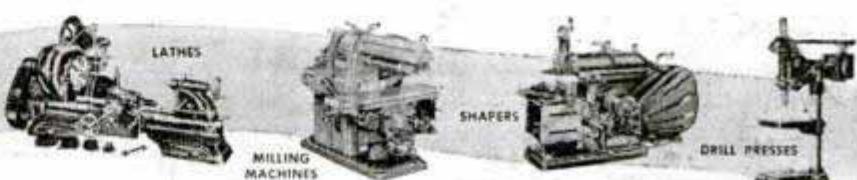
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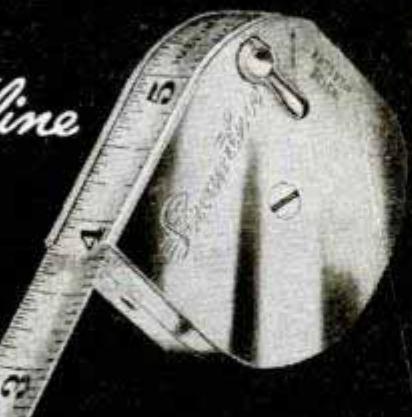


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Long Distance by Short Wave

(Continued from page 4)

automobiles and stationary phones. The conversation travels part of the way by low-powered radio sets and part by telephone wire. Another development, which does not involve radio, is a long distance dialing system which speeds service. The operator who takes your call can dial directly a telephone in a distant city without assistance of other long distance operators.

With their far-reaching experiments in the transmission of sound, Bell engineers have succeeded in making pictures of sounds. This "visible speech," heralded as an aid to the deaf, uses a cathode ray tube and screen. Sound pictures forming words appear in wavy patterns. The graph for the word "sure," for example, resembles an airplane in a dive. After a period of training, a deaf person can carry on a rapid telephone conversation by reading the phonetic graph. This innovation is the result of research spurred by the war and is therefore a distant cousin of radio relay.

The International Telephone and Telegraph Corporation, pioneer in radiotelephony, has developed a relay system which permits 24 two-way conversations at the same time on a single radio-frequency carrier wave. The wave is beamed by giant eight-foot "saucers," or parabolic reflectors, mounted on towers or high buildings. With relay towers placed at 30-mile intervals, a single circuit can cover thousands of miles. I. T. & T. engineers report successful application of their system to broadcasting of sound-color-television programs.

A feature of the radio relay system devised by the Radio Corporation of America is an automatic relay tower. It turns on and off automatically to transmit and receive every signal and requires no attendants at relay stations. This system will be used by the Western Union Telegraph Company in a 62 million dollar relay system which will link major U. S. cities. Experimental networks between New York, Washington, Pittsburgh and Philadelphia would permit the removal of 2500 miles of pole lines carrying 54,000 miles of wire, and 180 miles of aerial and underground cables. High-frequency radio beams can carry many more messages than the wires they will replace—1080 messages at one time.

Although radio relay is still experimental for domestic use, it is far from experimental as far as the Army and Navy are concerned. Its military designation, AN/TRC, means Army Navy Transportable Radio Communication.

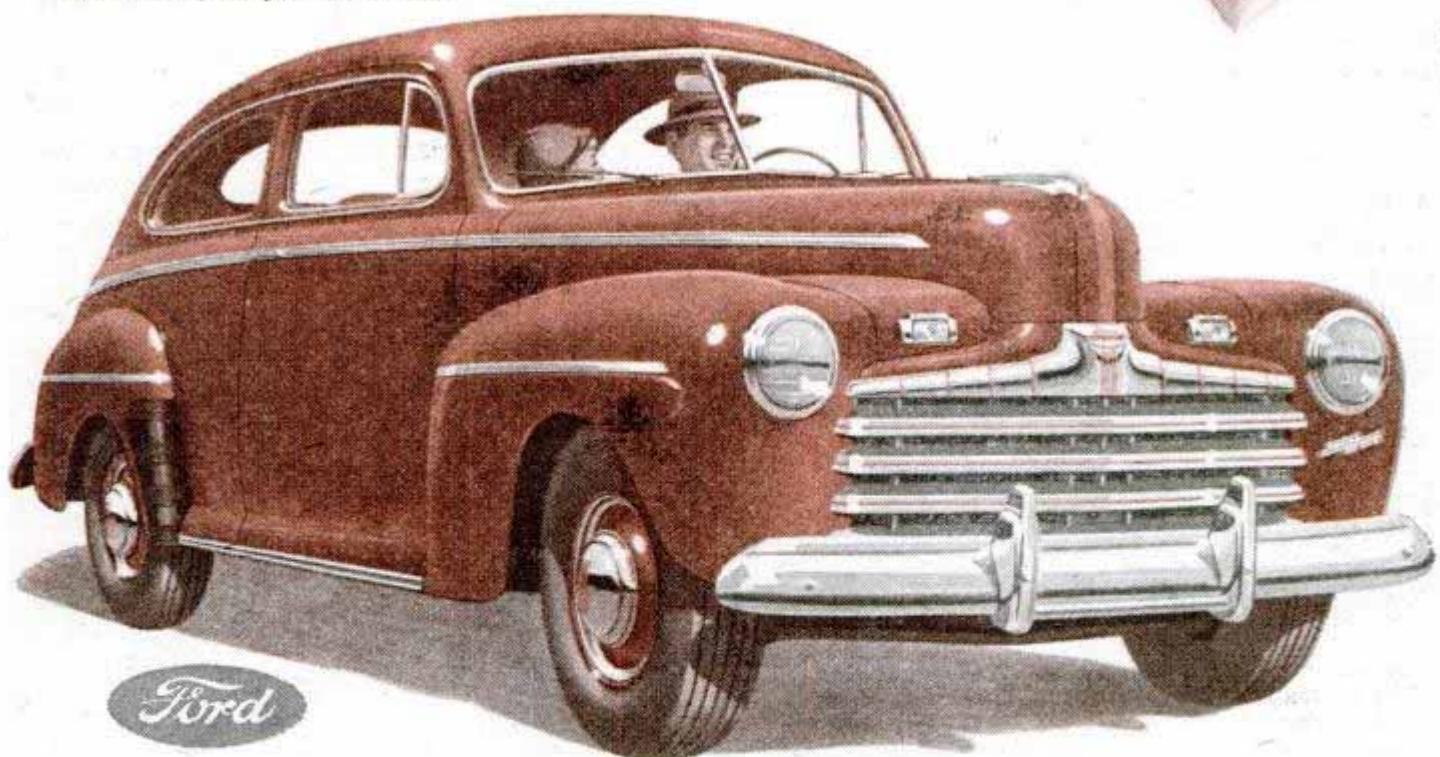
(Continued to page 164)

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Radio relay first was used by the Signal Corps in April 1943 to connect headquarters in Algiers with Tunisian combat areas. In Sicily, the radio links were invaluable because the enemy had destroyed all the line-wire circuits on the island. The first multichannel radio sets were introduced during the invasion of Normandy. They carried four simultaneous voice circuits, any one of which could be used to transmit four teletype signals.

When General Patton's Third Army swept across France there was no time for laying wires, and ordinary single channel radio, which naturally offered no additional facilities for telegraph, teletype and facsimile, could not do the job. The answer was portable radio relay stations which spanned rivers and desolate countryside.

"Our rapid drive across France was dependent upon a shoestring," said General Omar Bradley recently. "That shoestring was radio link."

The relay station network that began in France followed the armies over the Siegfried Line, made it possible to establish communications across the Rhine after the Remagen bridge break-through, and even maintained contact with our troops trapped in the famous Battle of the Bulge.

Radio relay played an equally important military role in the Pacific. It linked fighting units of soldiers, marines and sailors all the way from Guadalcanal to Tokyo. Telephone messages, teletype, photos and maps were flashed by radio beams over tropic jungles where wire communication was impracticable. The craftiest Jap in the jungle couldn't sever a radio beam.

At H-hour plus 2, an LCM landed radio relay equipment on the beach of Leyte Island. A half hour later, communication had been established with a Command Post Fleet (ships converted into communication centers). At H-hour plus 5 General MacArthur came ashore and broadcast his "I have returned" address over radio relay which was picked up and rebroadcast to the Philippines. Later in the Luzon campaign, radio relay sets carried 75 percent of the military telephone and teletype traffic.

The men whose lives depended on radio links during the war freely predict that the folks at home will find it just as useful as they did—and in the near future.

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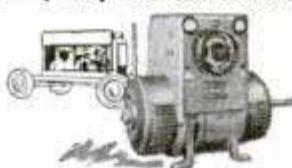
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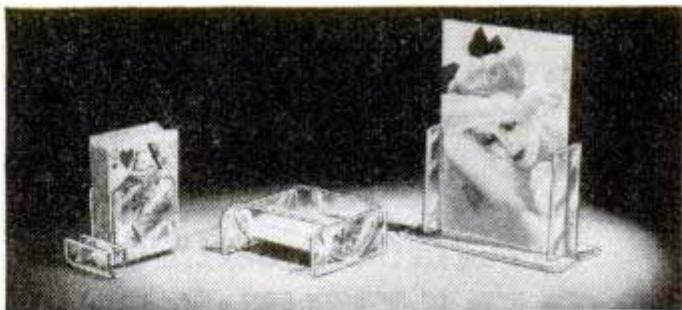
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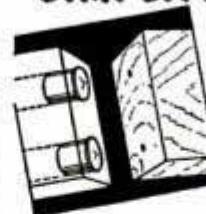
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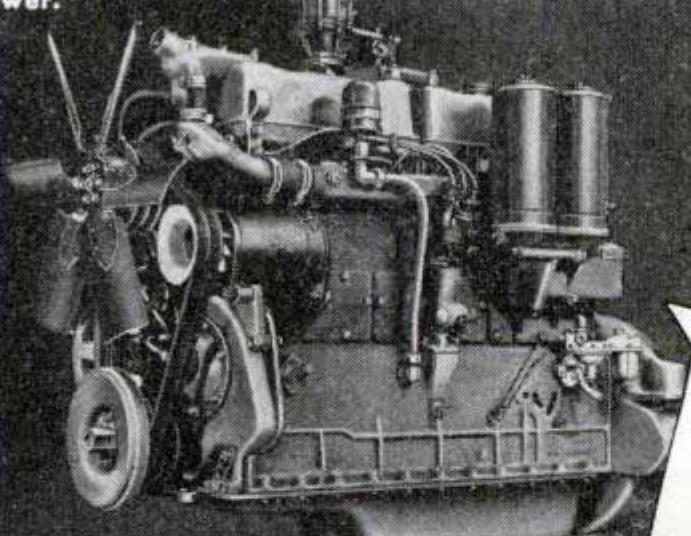
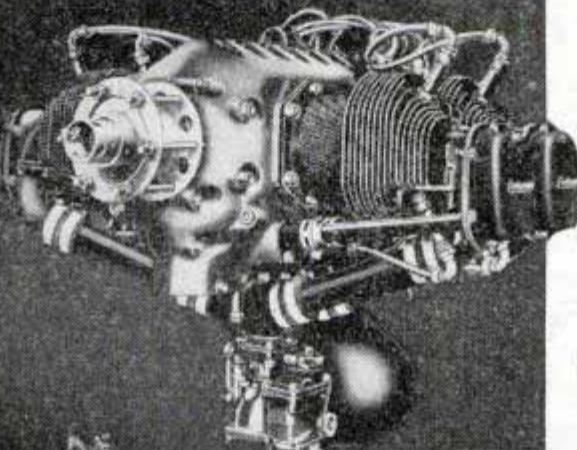
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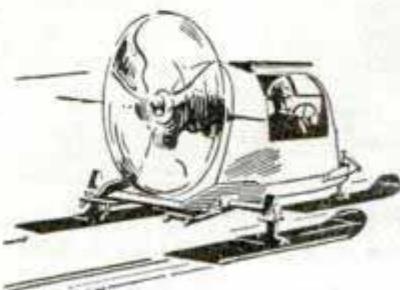


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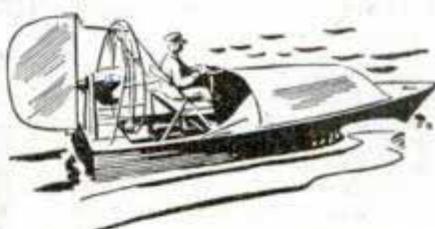
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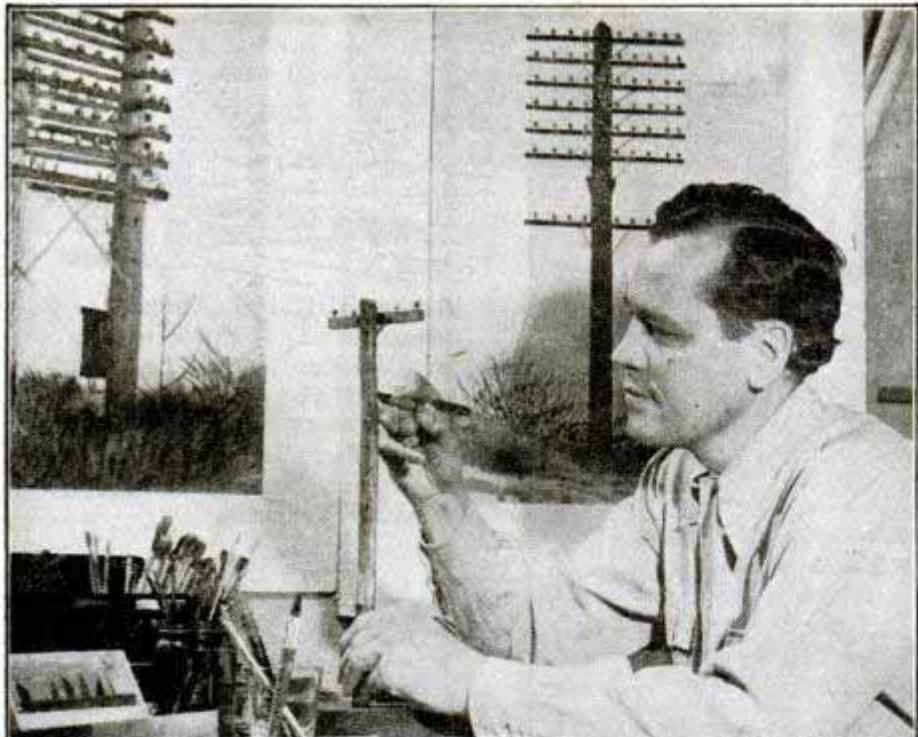


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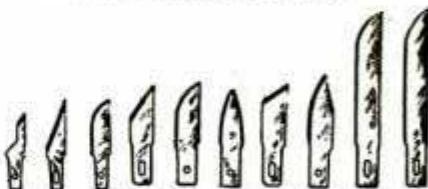
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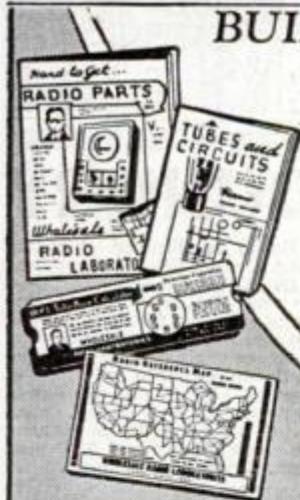
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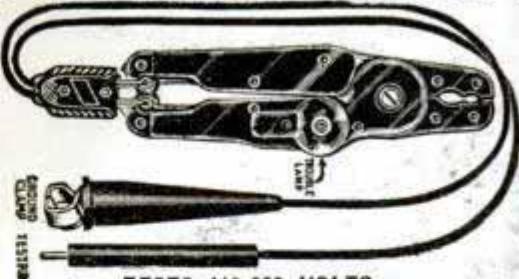


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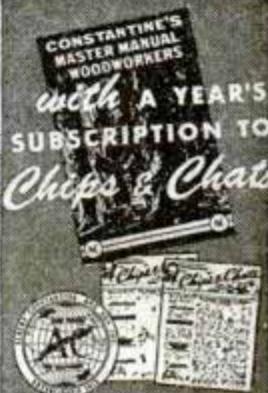
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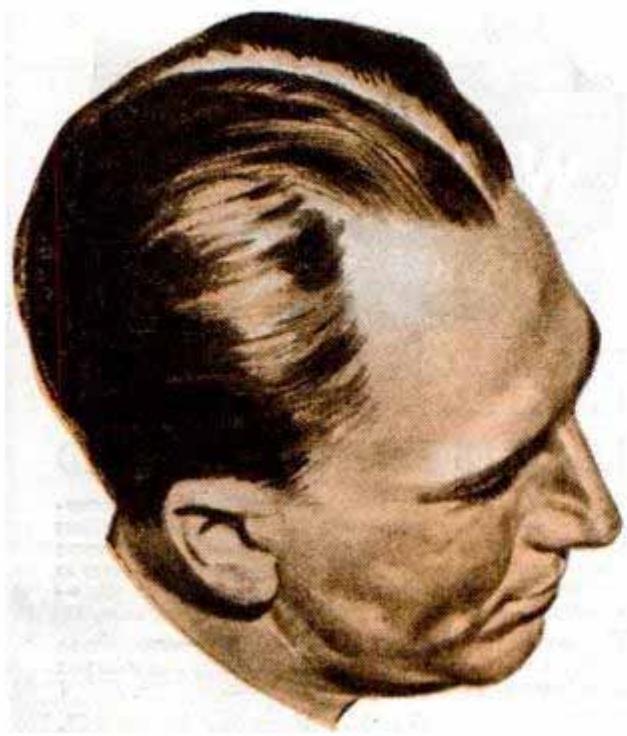
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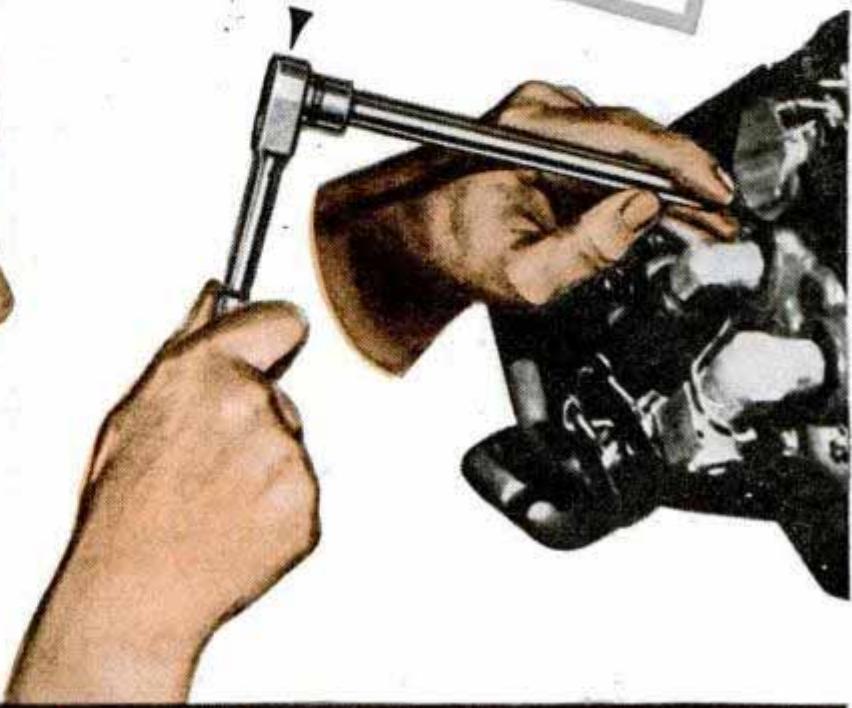
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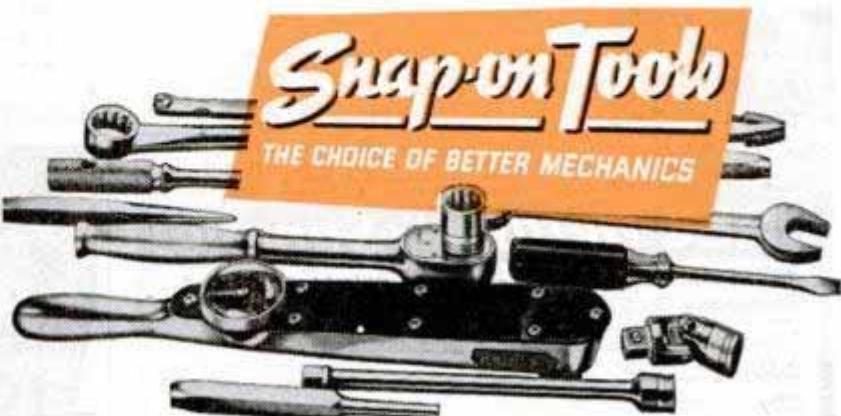
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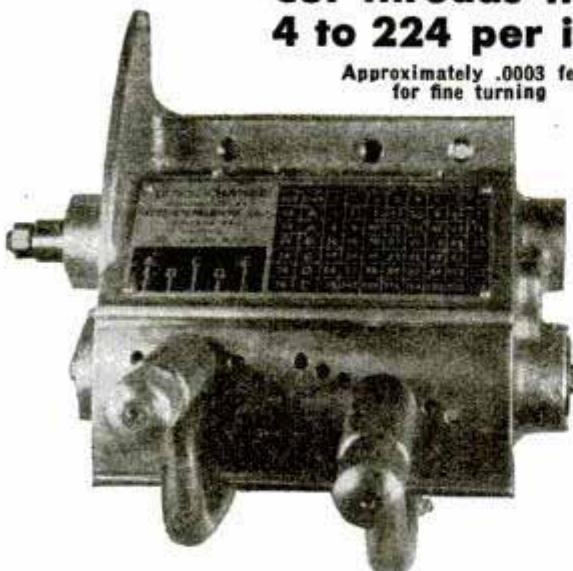
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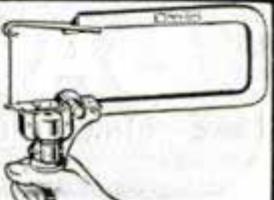
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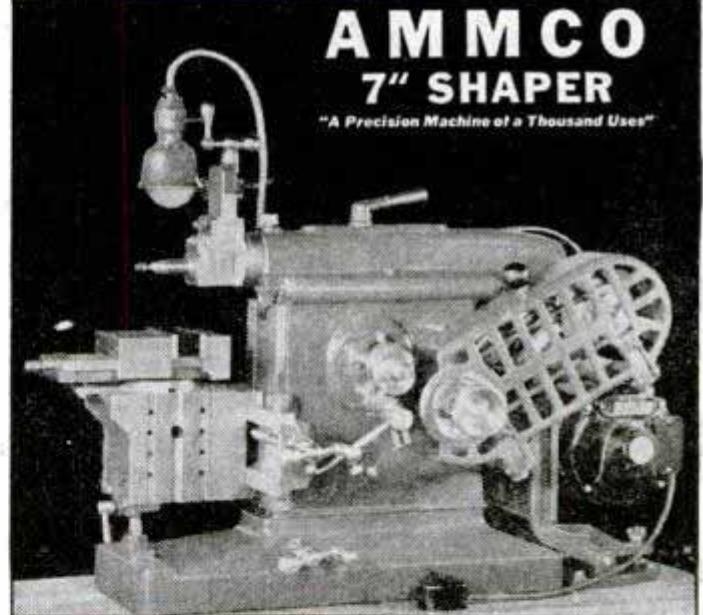
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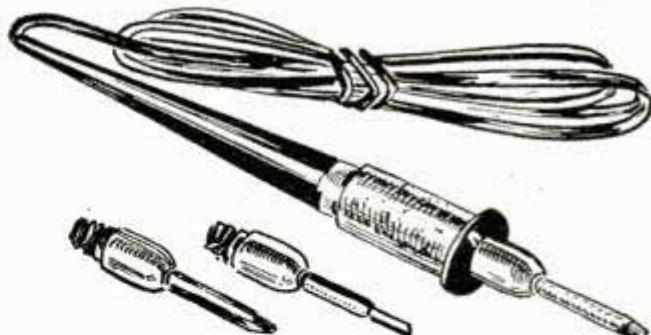
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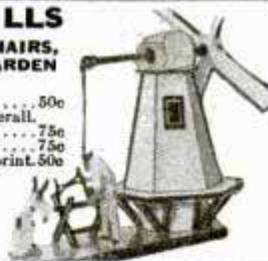
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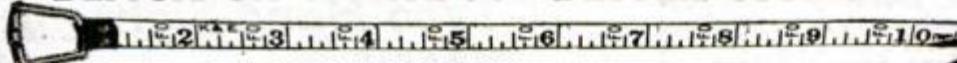
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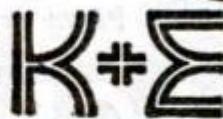


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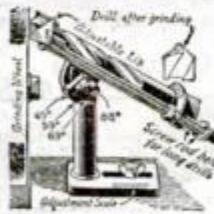
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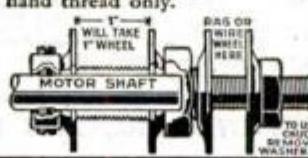
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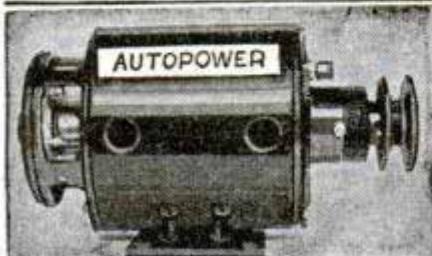
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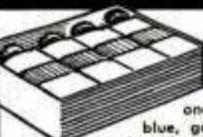
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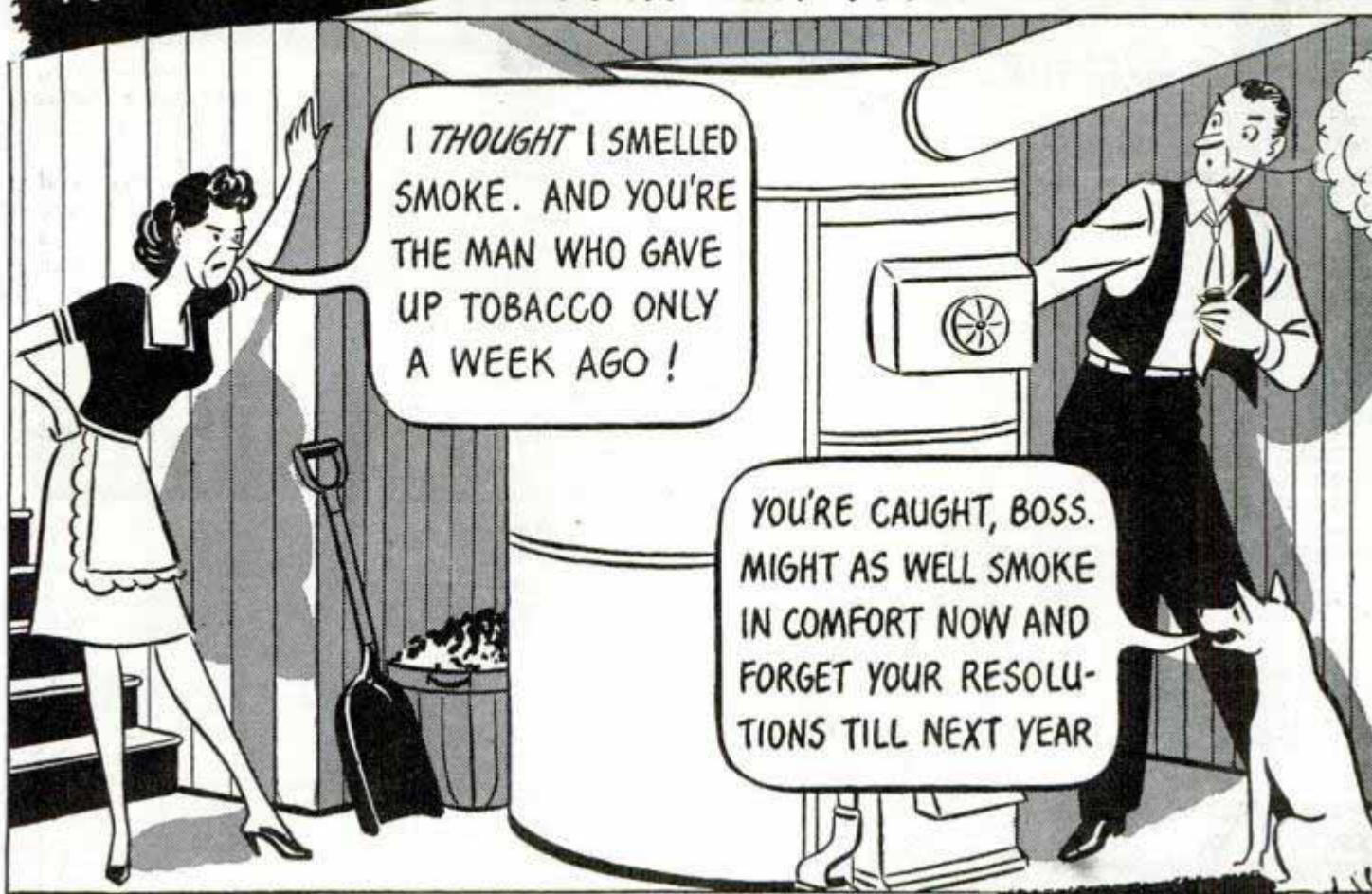


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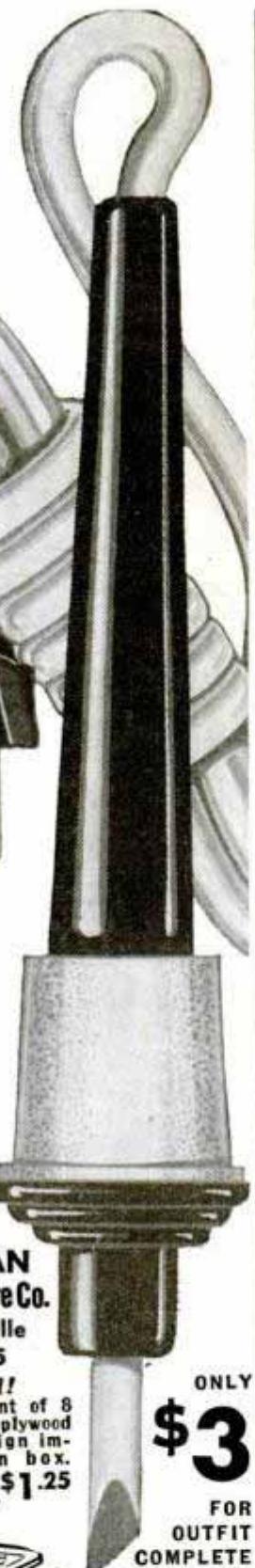
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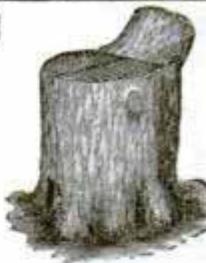
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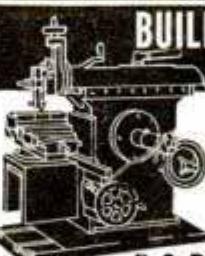
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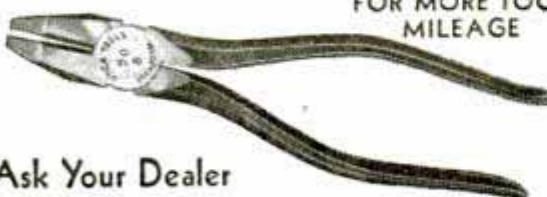
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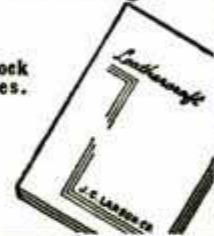
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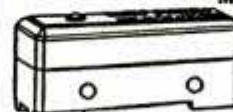
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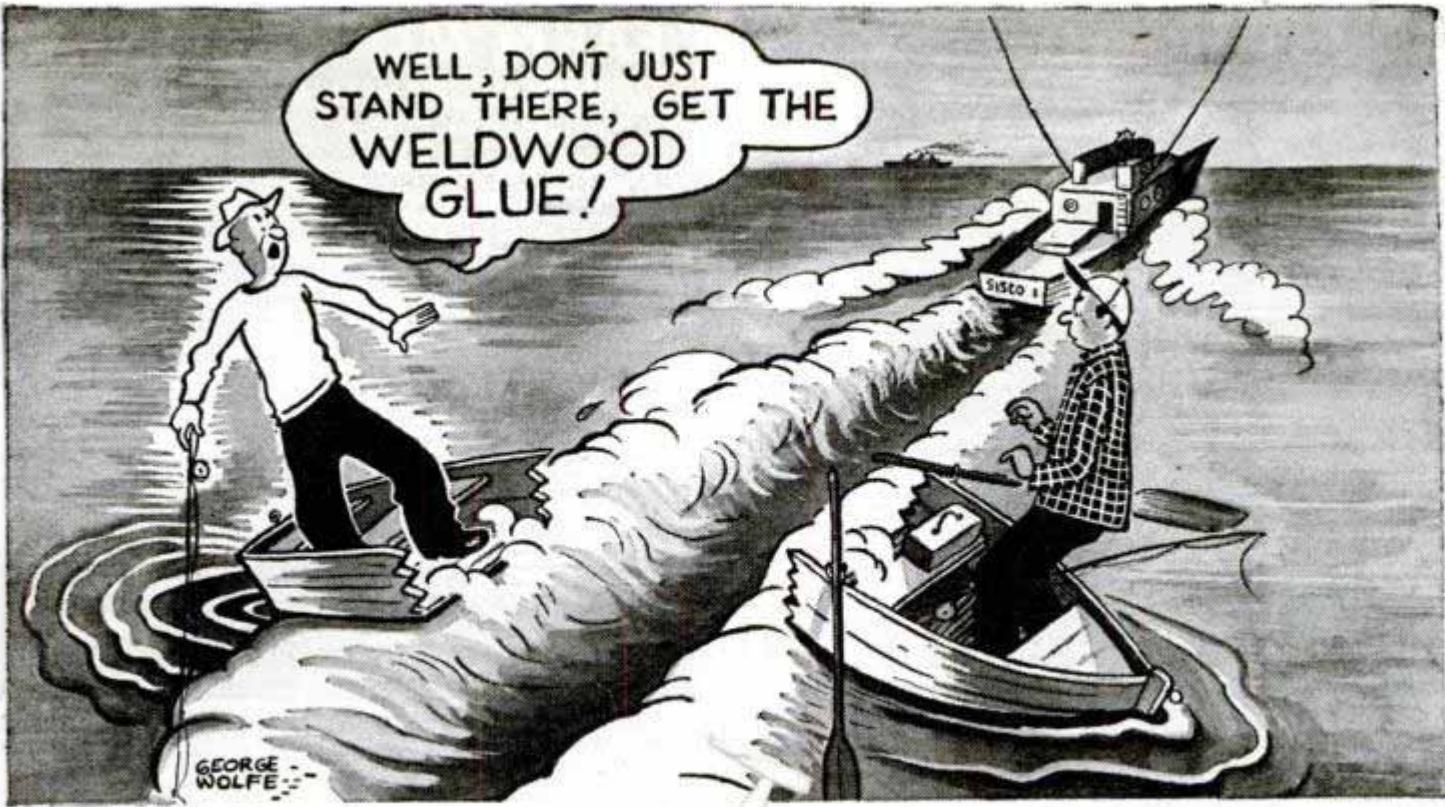
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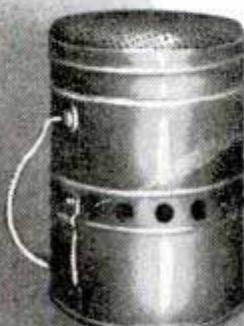
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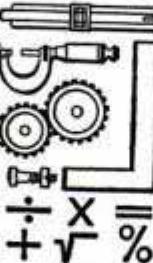
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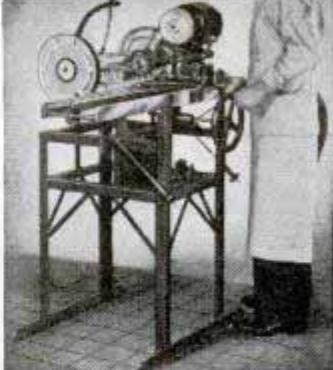
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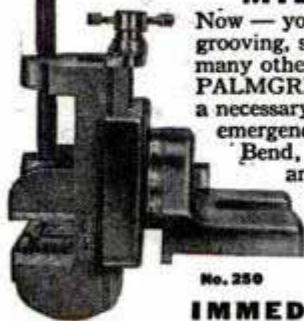
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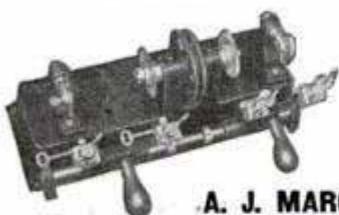
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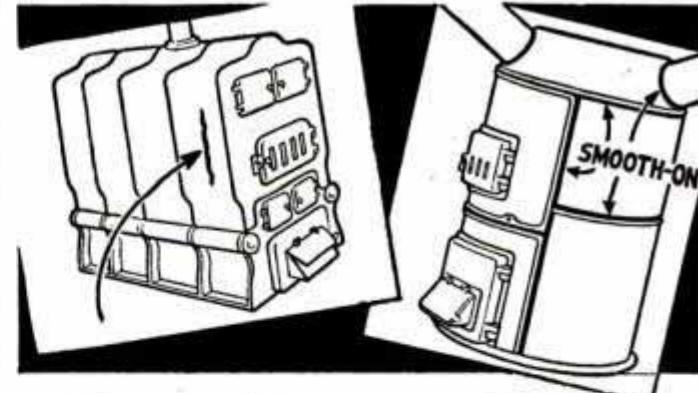
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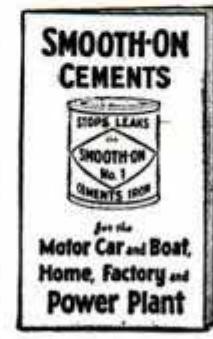
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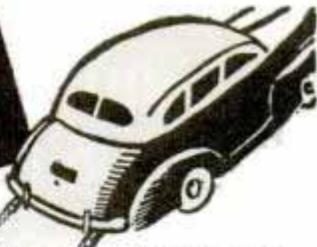
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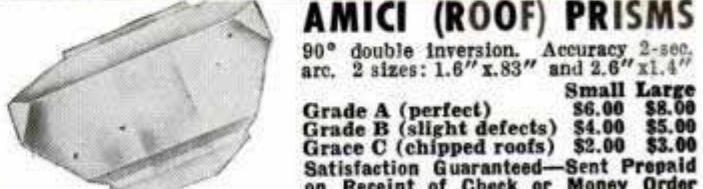
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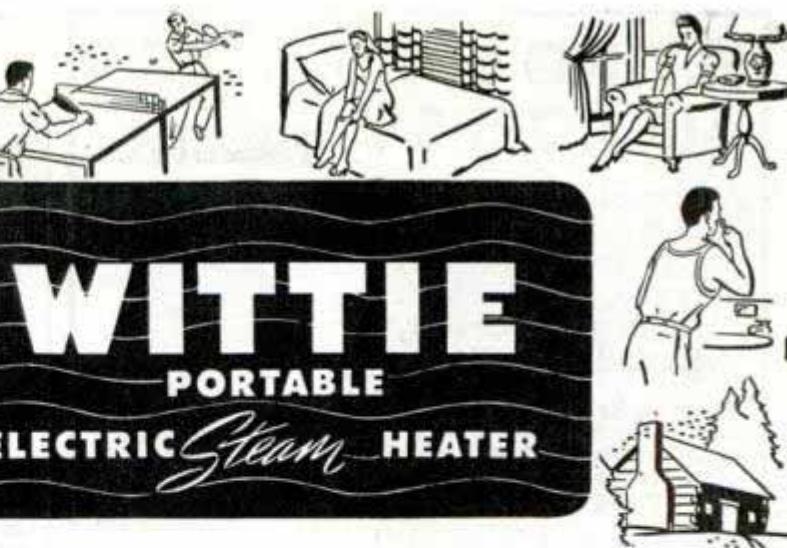
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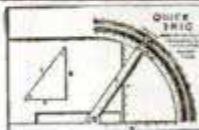
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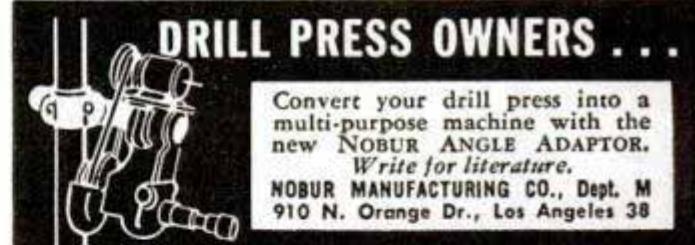
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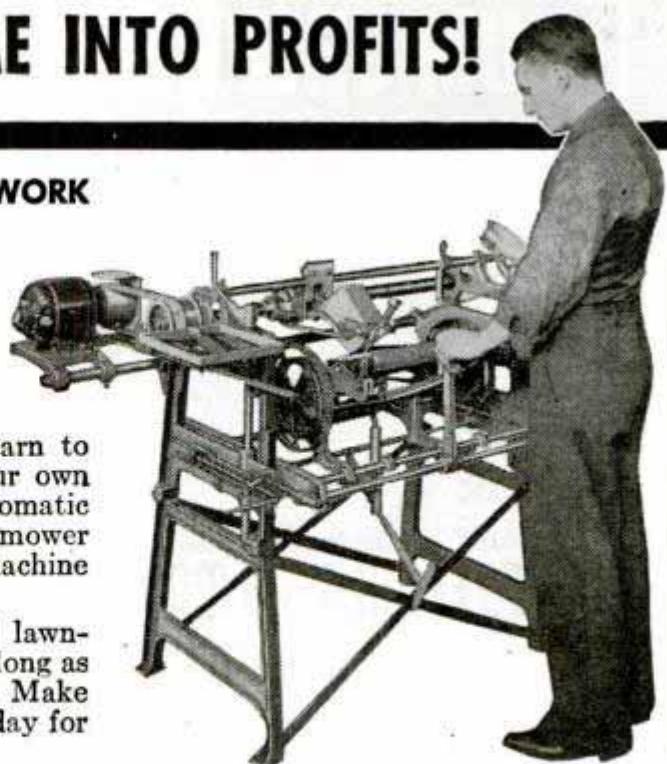
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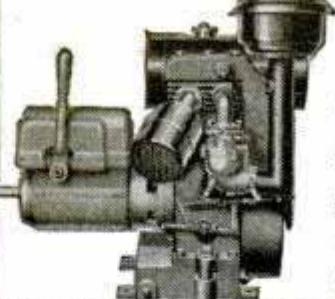
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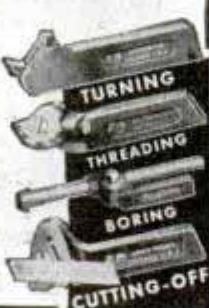
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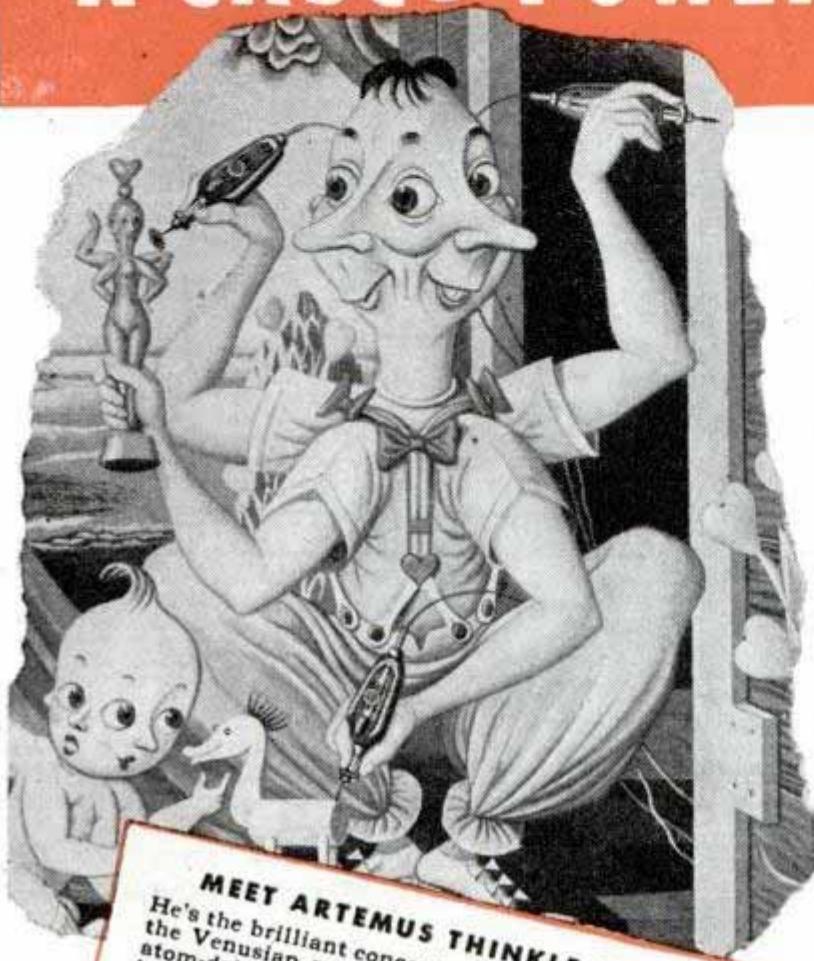
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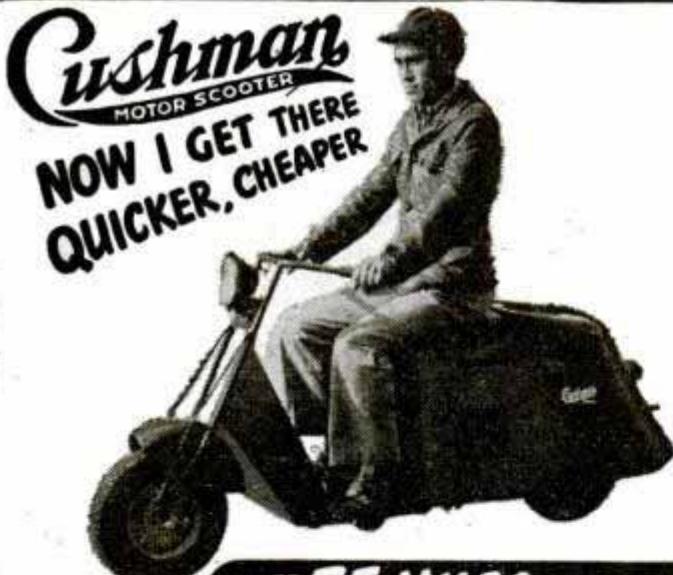
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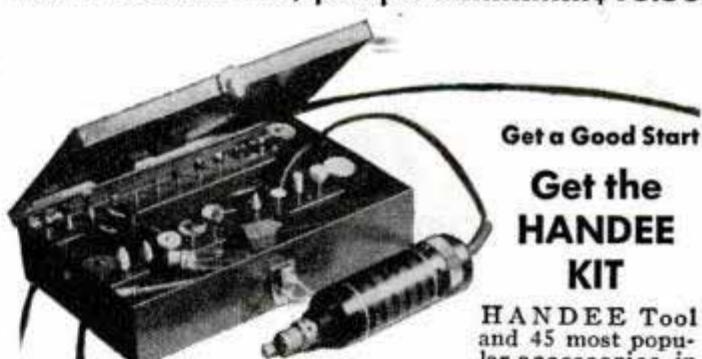
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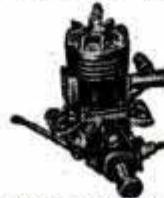


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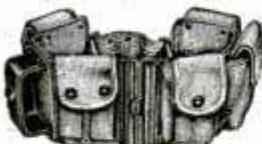
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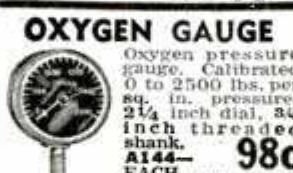
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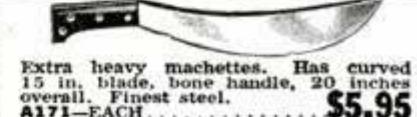
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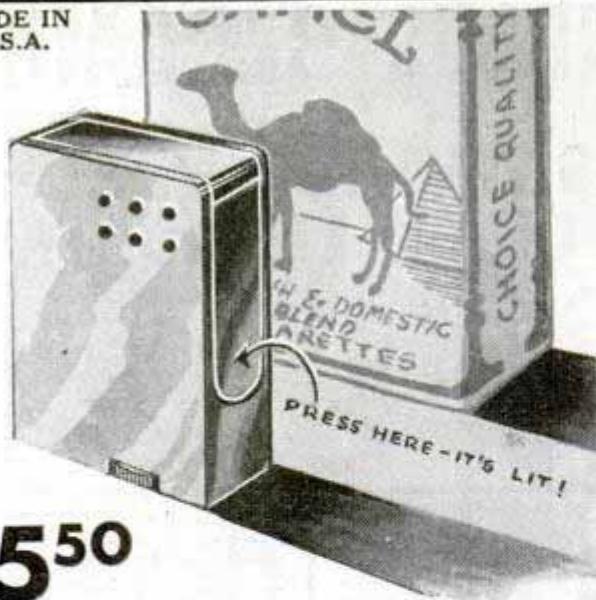
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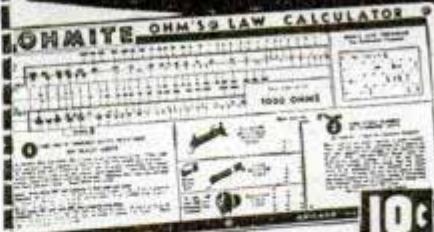
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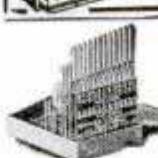
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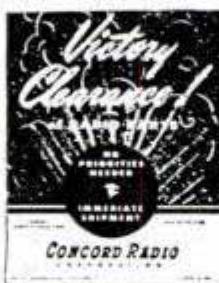
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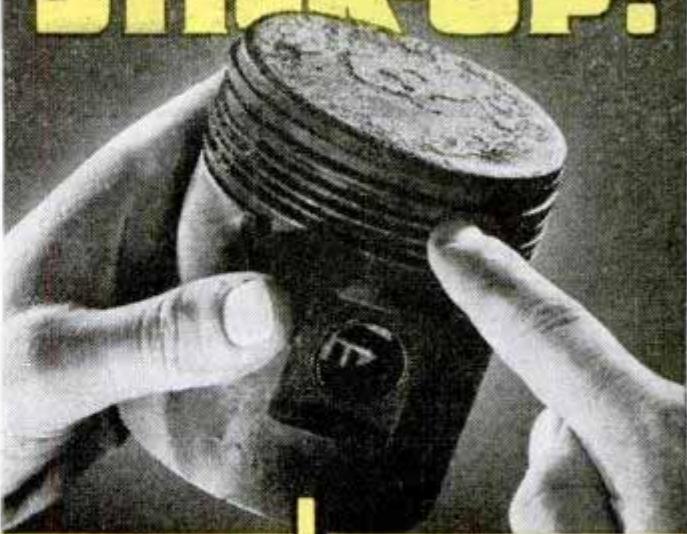
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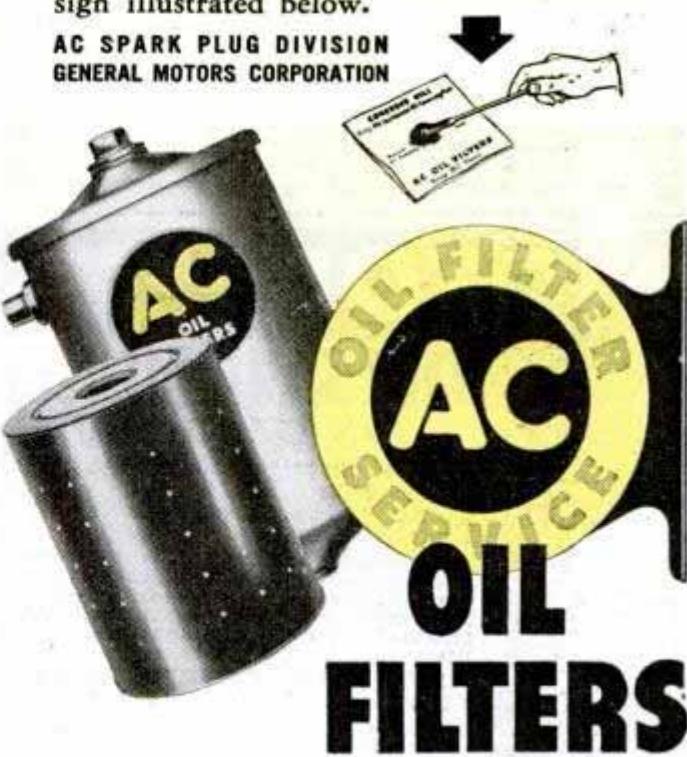
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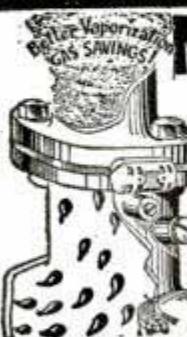
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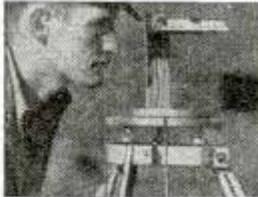
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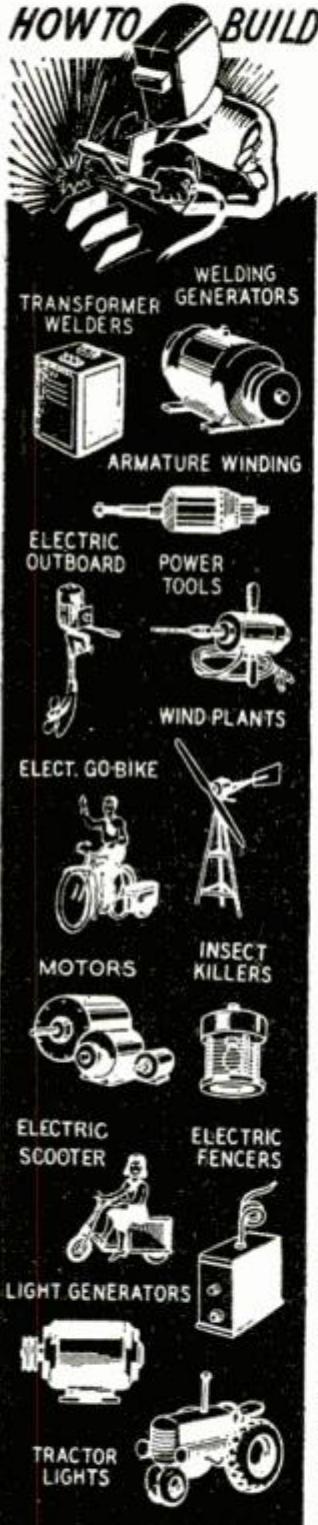
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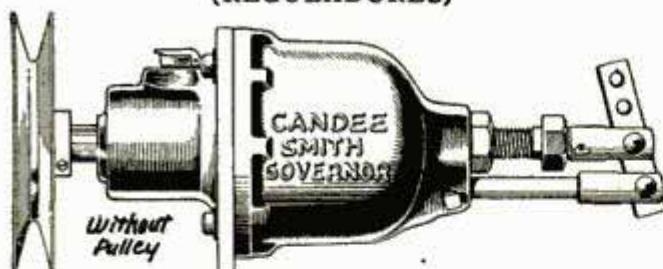
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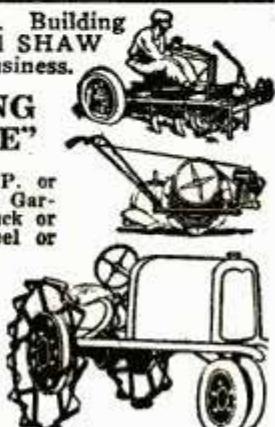
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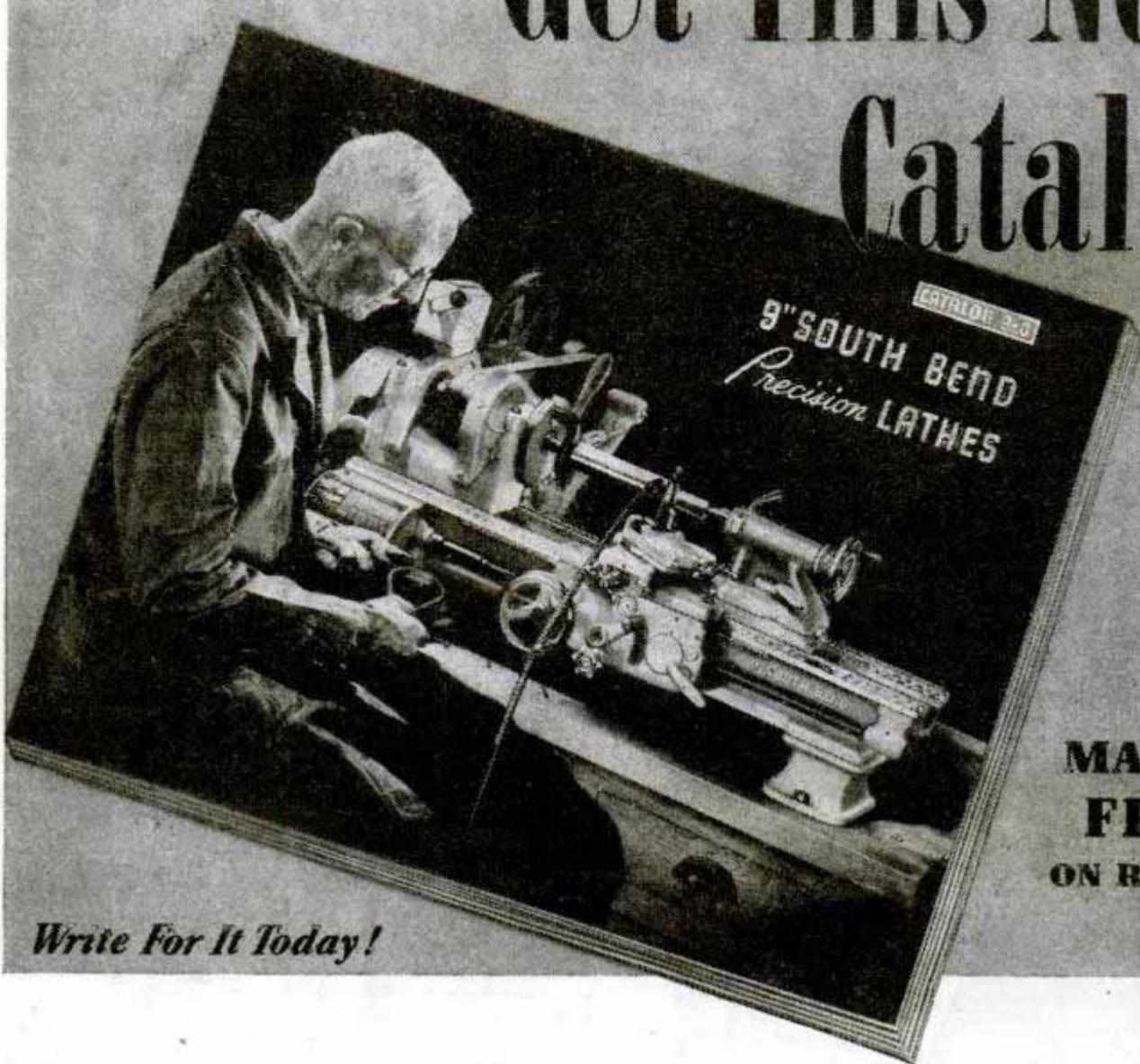
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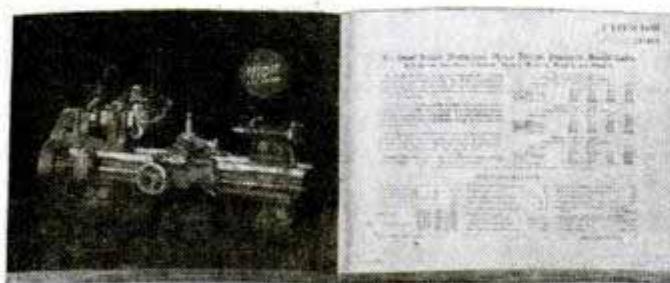
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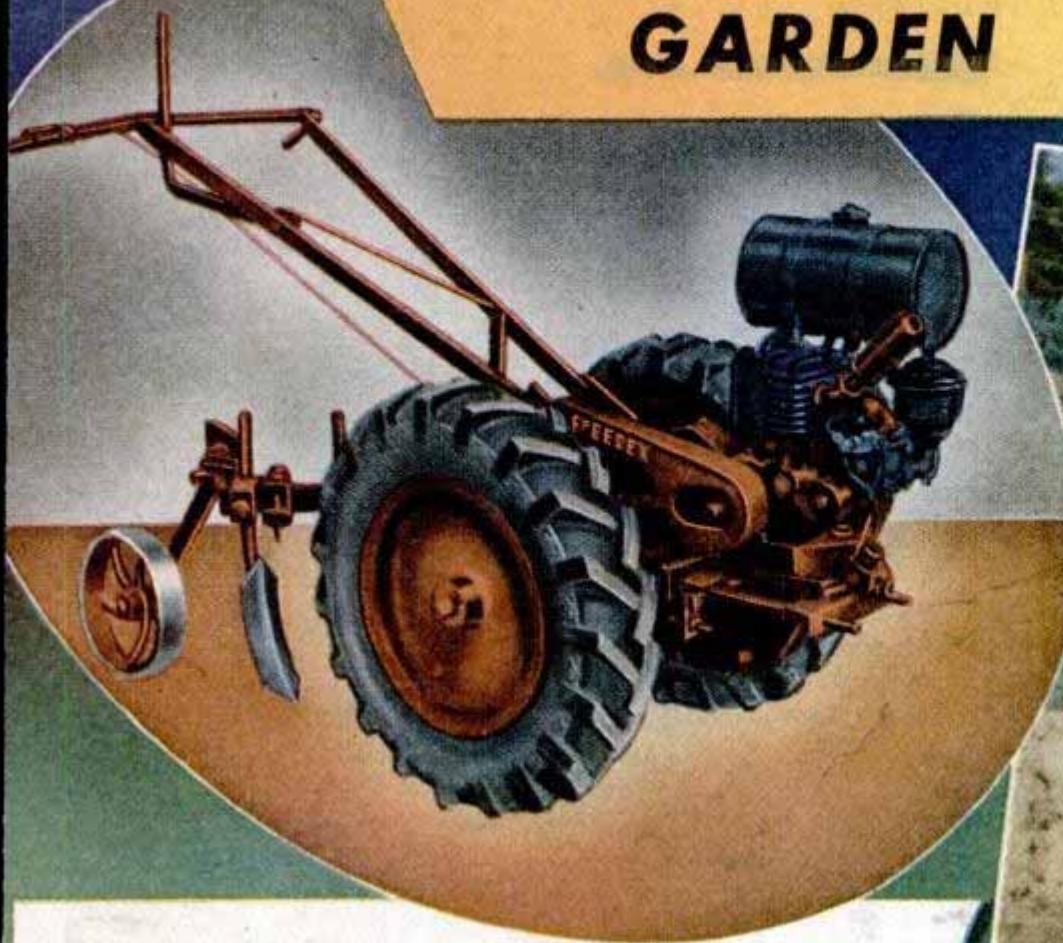


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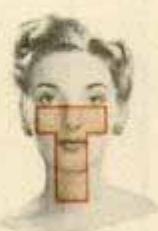
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